

Consulting Engineer

April 1959



Photo by Fabian Bachrach

LESLIE C. GATES, owner of Ferguson-Gates Engineering Co. and partner in Gates and Genovese, Consulting Engineers, both of Beckley, West Virginia, thinks the voice of the consulting engineer, to be effective, must be blended with the voice of the entire engineering profession. With this goal in mind, Gates helped to organize — and now heads — the Functional Section for

Continued on page 12

You may have ordered this valve trouble

You may even now be specifying or paying for wear like this and not know it! How? By using specifications for bronze valves dated earlier than the introduction of OIC *Alloy-40*, a bronze stem alloy which eliminates galling and seizing, and minimizes thread wear.

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New high in combustion efficiency and fuel economy

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This compact Iron Fireman WhirlBlast unit combines many of the advantages of big burners, yet it requires little more supervision than the oil or gas burner in your home.

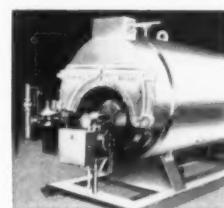
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Consulting Engineer®

The Consulting Engineer's Professional Magazine

Wayne near Pleasant Street
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April 1959 • VOLUME XII • NUMBER IV

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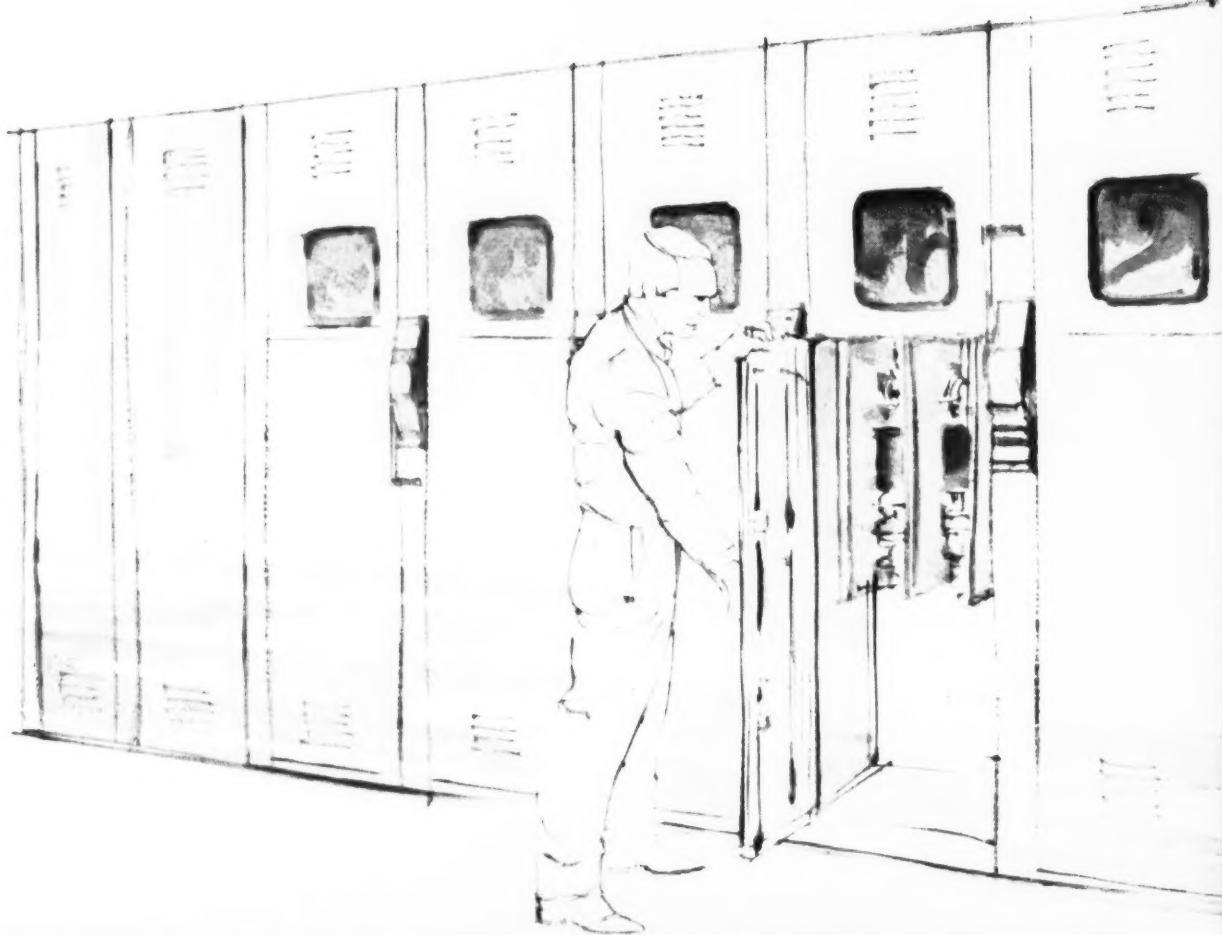


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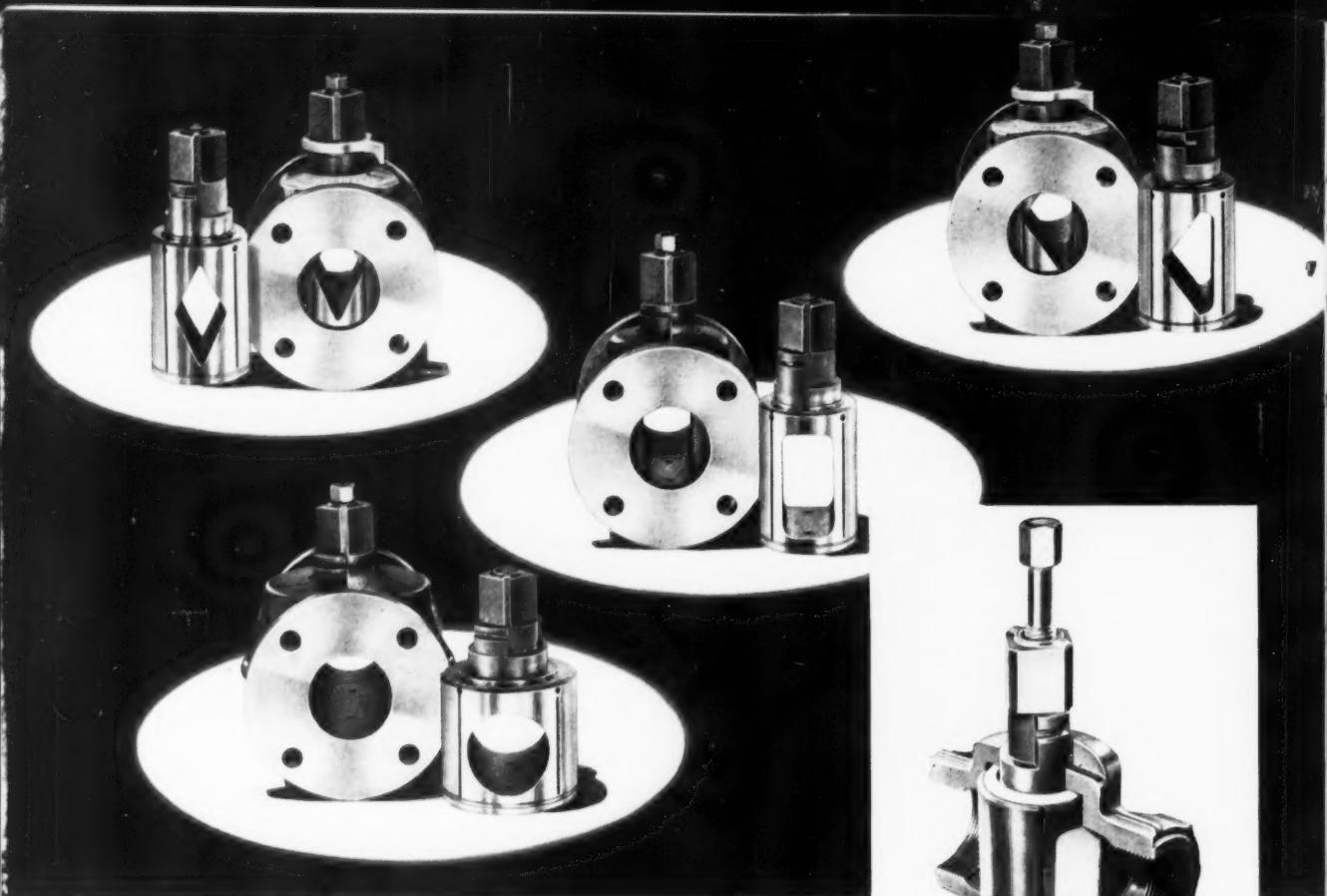
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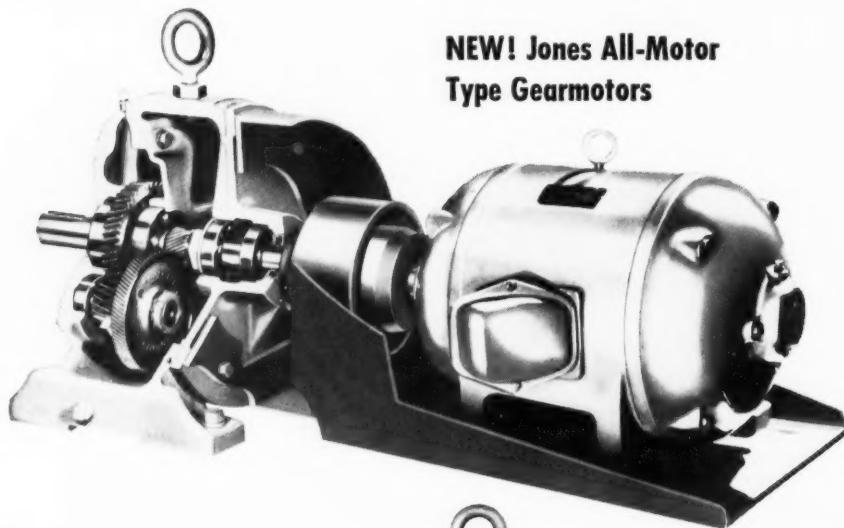
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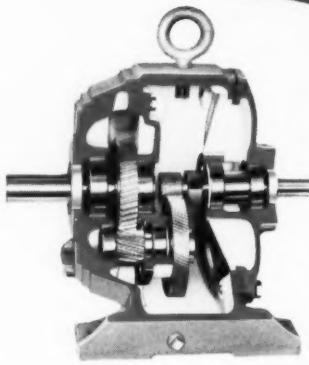
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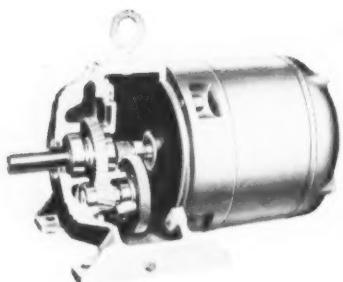


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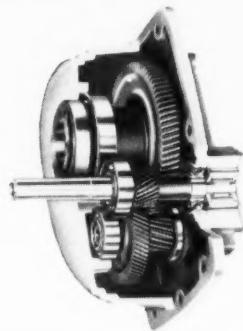
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**NEW!
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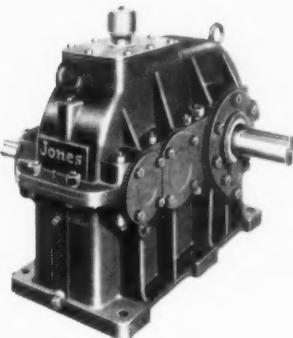
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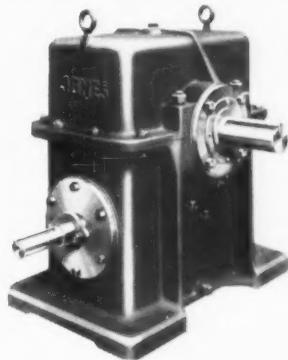
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Herringbone Gear Reducers	Bulletin 4-13-100
Worm Gear Reducers	Bulletin 4-13-J13
Worm-Helical Reducers	Bulletin 4-13-J14



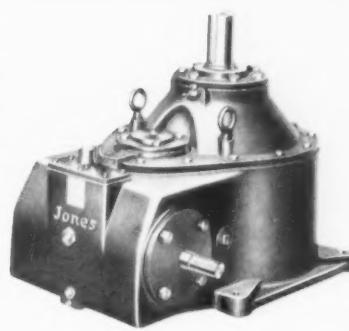
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Leslie C. Gates

— Starts on front cover

Consulting Engineers in Private Practice of the National Society of Professional Engineers.

"The public will accept a recommendation from an over-all professional group as an unbiased opinion, while it might think of a recommendation from a group of that society or a group outside of the society as a prejudiced opinion," Gates explained. "My feeling, generally, is that factors adversely affecting the consulting engineer eventually will have an adverse effect upon the entire engineering profession. And even more important — upon the general public."

Professional Society Activities

Gates' interest in functional sections actually predates by several years the formation of NSPE functional groups on a national level.

One of Gates' first activities upon returning to Beckley, after serving in the European Theater as executive officer with a Combat Engineers Battalion, was to help organize a local chapter of NSPE. Prior to Gates' return, Beckley engineers had traveled more than 50 miles to attend NSPE chapter meetings in neighboring counties. Today the Appalachian Chapter covers approximately six counties and has more than 100 members. Gates was the chapter's first president.

Gates soon became active in the West Virginia Society of Professional Engineers, serving as second and then first vice president. He was elected president in 1951. At that time, more than four years before NSPE gave the national nod to functional groups, the West Virginia Society had several functional sections. "However, consulting engineers did not recognize their mutual problems as they do today, and their functional section was not very active. We had an added problem. There are not too many consultants in West Virginia."

In 1955, NSPE recognized the need for functional sections for engineers in private practice as well as for other groups with mutual professional problems. "Prior to the formation of the functional groups, committees would study any problems that came before NSPE. However, it was obvious that groups such as the consulting engineers' needed a mechanism for handling matters directly affecting them. Thus, the functional sections were formed."

Gates added that he had not heard of the formation of the Consulting Engineers Council that same year, and the only effect the new group could have had was in "accelerating the inevitable," the formation of the functional sections.

Gates served as chairman of the Engineering Practices Committee, a group formed to assist in

establishment of functional sections for consultants. Today, he heads the Functional Section for Consulting Engineers in Private Practice as well as the Engineering Practices Committee. He thinks the functional sections are working out well. "It is too early to judge us on a basis of accomplishment. After all, we still are suffering from growing pains, and it is impossible for any organization to achieve maximum efficiency in only two years. But we are making progress. Prior to the formation of the Section, the engineer in private practice had no chance to express his views collectively to NSPE. Now the situation has changed to a point where the NSPE board of directors and executive committee refer many problems to our Section."

How can consulting engineers discuss mutual management problems when any member of NSPE, including their own employees, have the right to join the functional section?

"As I see it, the interest of the employee is the same as the interest of the consultant."

What about such matters as fee schedules and "free engineering"? Are those not business problems?

"I will admit there sometimes is a thin line between what is a business and what is a professional problem. However, it depends on the approach.

"For instance, our Section is working on a fee schedule. This is in no way an attempt to regulate any business practices. It merely is a compilation of existing fee schedules in the various states and will be distributed as information.

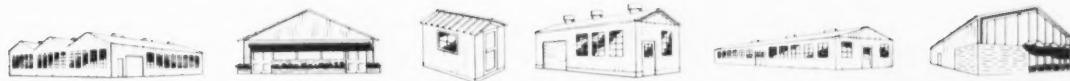
"As for 'free engineering,' I think this definitely is a professional problem. NSPE was formed first to serve the public, and secondly to serve the engineering profession.

"Engineering is a profession and must be approached in a professional manner. The public eventually can be made to realize they will not get the best design from 'free engineering,' turned out by engineers who have the status of cogs in a large machine. Making the public realize this is a job for the entire engineering profession, not merely for one portion of the profession."

What about the Consulting Engineers' Section in Kansas, with what amounts to membership by firms instead of individuals? Is that not a business approach to professional problems?

"It is not my understanding that membership in the Kansas Section is by firms. Rather, to the best of my knowledge, membership is on an individual basis, principals and employees alike, with firms supporting the cost of the Section in proportion to the size of the engineering firm. Further, the assessment schedule is voluntary. Individual dues are pledged in addition to the firm subscriptions.

"Naturally any functional section (and NSPE, for that matter) is interested in the general eco-



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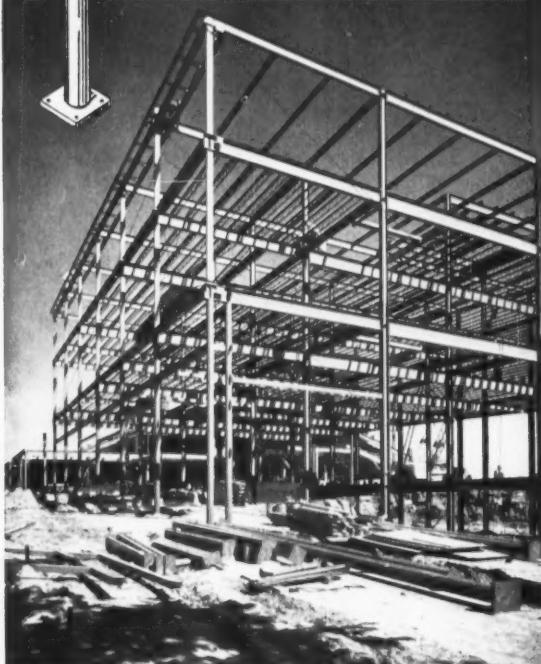
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APRIL 1959

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conomic well being of the engineer. For that reason it will concern itself with matters of a business aspect that have an economic influence on the engineering community. However, this certainly does not place it in the same category as a trade association which may intervene in certain situations in an attempt to obtain work for specific firms and which oftentimes is patently selfish in its approach to matters affecting its membership.

"In the case of the Kansas Section and in the case of the NSPE Functional Section this selfish approach is not apt to develop because final action and public utterances or news releases must first be submitted to and approved by the State or National Board of Directors. Actually, I think it would be a serious mistake to try to divorce the professional and business problems of the engineer.

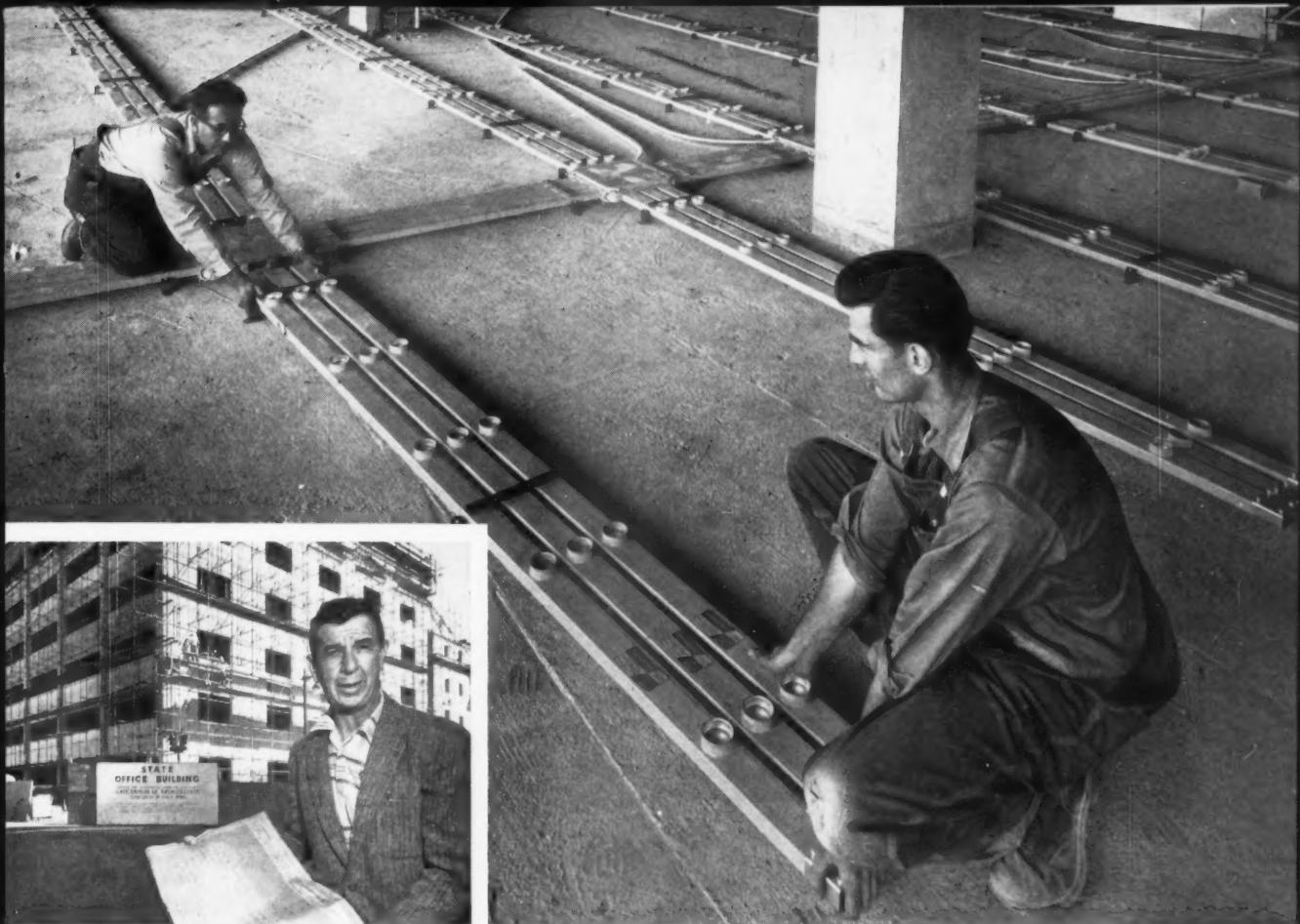
"The state societies and the National Society act as check balances against possible injudicious activities of functional sections. Contrariwise, functional sections serve to counteract the possibility of state or National Society activities in fields which may be injurious to the membership of these functional sections.

"Words, both written and spoken, are subject to misinterpretation. Although I am not intimately familiar with the internal workings of the Kansas Section, I have been in correspondence with it through its secretary. Regardless of words which may appear to the contrary, I have never felt that the philosophy of the Kansas Section is anything but in conformity with NSPE functional section philosophy."

What are the NSPE Functional Section for Consulting Engineers' plans for the future?

"One of our current projects is a study of our present and future financial needs. We have obtained authorization from the Board of Directors to raise funds for administrative purposes. A committee, headed by A. C. Kirkwood, of Kansas City, currently is studying the needs and possible means of obtaining the needed funds.

"Some of our other current projects at the national level are: Improvement in per diem limitations for consultants under Federal laws, extending the benefits under professional liability insurance, passage of Keogh-Simpson Bill for retirement benefits for self-employed consultants, preparation of a roster or listing of consulting engineers, engineer-architect contract forms (which will be available shortly), continued liaison with architects through AIA, and several pending legislative items affecting consulting engineers, such as opposing the provision in a bill which would allow a Federal agency to render consulting engineering services outside of its own jurisdiction. Over-all, we are able to keep advised of all Federal legislation



Mr. Reave E. Teague, Project Supervisor for Patterson-Emerson-Comstock, Inc., reports, "We like SPANG Underfloor Duct because all component parts fit together with a minimum of effort; SPANG has obtained maximum flexibility in their Underfloor Duct System with the fewest possible parts."

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Subsidiary of Armco Steel Corporation



TWO GATEWAY CENTER, PITTSBURGH 22, PENNSYLVANIA

which might affect consulting engineers and refer it quickly for study, recommendations, and action, if justified, with support from the grass-roots level, —the basic characteristic of NSPE's organization.

"We would like to have additional staff assistance in the Washington office, plus some additional clerical help. Right now it is difficult to maintain any continuity as Section leadership changes. And much of the clerical work is being donated from the offices of the consulting engineers who are serving on various committees."

In addition to his work with NSPE, Gates is active in and has served on local committees for the American Society of Civil Engineers and the Mining Division of the American Institute of Mining, Metallurgical, and Petroleum Engineers. He also is a member of the West Virginia Coal Mining Institute.

Business Activities

Ferguson-Gates Engineering Co., which Gates now owns, dates back to about the turn of the century. The late Lauren A. Gates, his father, was active in the firm until his death last year.

"Our principal interest at Ferguson-Gates is in coal land and its development. We make appraisals and valuations on developed and undeveloped properties. We conduct periodic inspections of coal properties under lease and submit reports

detailling the condition of the mines, estimating coal recovered and that remaining, and keeping continuous records of mining throughout the life of the property."

This firm is small (four registered engineers and one draftsman) because the specialty has its limitations. But it has an impressive list of railroads, land holding companies, and large business corporations as continuing clients. Some of the active accounts date back more than 20 years.

Gates also is a partner in Gates and Genovese, Consulting Engineers, which specializes in highway and bridge design. Gates formed this partnership with Philip W. Genovese, of Philip W. Genovese & Associates, New Haven, Conn. Although only one year old, this organization currently is working on a \$2-million highway design project and a \$100,000 bridge design, and has 40 employees.

Both of Gates' engineering organizations do all of their work in West Virginia and the immediately surrounding areas.

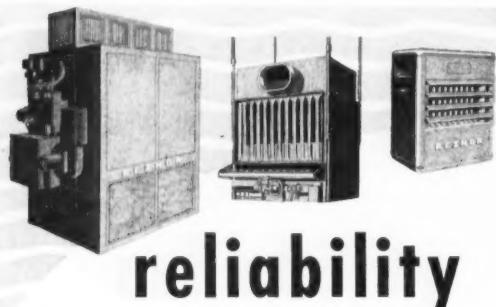
"Gates and Genovese was formed with the specific aim of doing highway design in West Virginia," Gates explained. "Right now, there is only one other consulting firm in the State which handles projects of this type. It is no secret that the West Virginia Highway Department cannot handle all design for the current and proposed highway programs, and I see no reason to make the Highway Department go out of the State to find competent consulting engineering organizations to do the design work."

Engineer in Two Fields

For as long as he can remember, Gates wanted to be an engineer. His father invited him to join the Ferguson-Gates Engineering Co., but he wanted to specialize in highways and bridges. He finally compromised by doing both. "I find that civil and mining engineering are compatible, and I am a registered professional engineer in both branches in two states," he added.

After graduating from Virginia Polytechnic Institute as a civil engineer, Gates joined a field party with Solvay Process Company, Hopewell, Virginia. One year later, he joined the U. S. Army Corps of Engineers, where he rose to the rank of Major, and most of World War II he served in an administrative capacity. Landing in Europe on "D plus 4," he supervised the building of many temporary bridges and spent most of his time on advance liaison assignments near the front.

Shortly before he was released from the Army, Major Gates received a letter from his father saying that his partner, J. M. Ferguson, had died and he would like young Gates to join the firm. He became a partner 10 years later. □



Reznor heaters are designed and built for long life and reliable service. They've proved their ability to do the job in countless thousands of commercial and industrial installations. Quality always pays off in the long run. When you specify Reznor equipment you can be confident that you're specifying a quality heating system which will give your client years of trouble-free service with minimum maintenance.

RELIABILITY is just one of many reasons why there is no "equivalent" for Reznor . . . the world's largest-selling gas unit heater. Ask your Reznor distributor for the complete story or write for your free copy of "Modern Heating".



TRUCK ASSEMBLY SYSTEM



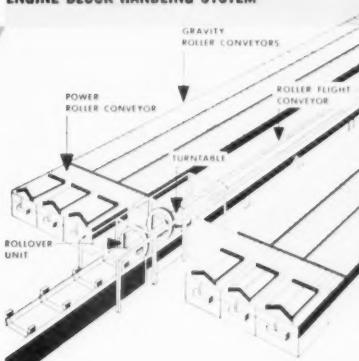
LOG AND CHIP HANDLING SYSTEM



AUTOMATIC SHAKEOUT SYSTEM

PV

ENGINE BLOCK HANDLING SYSTEM



PLANOBOT UNIVERSAL TRANSFER DEVICE



FINDS THE ANSWERS

If you have a production, materials handling, or automation problem, "PV" will save time and money, and increase efficiency and production. "PV" stands for *Planet Versatility* . . . a quality that has made Planet Corporation known throughout industry as an organization that has the solutions to the most perplexing problems.

Planet Corporation is an organization of experienced, creative engineers who, by applying uninhibited thinking to your problems, save your time in finding workable solutions that increase your efficiency. No job is too big or too difficult — they have designed complete foundrys, automated production lines, built bulk and unit materials handling systems, developed the world's only true universal transfer device . . . all types of special handling and automation machinery, and materials handling equipment.

No matter what your project, "PV" means that it will pay you to have Planet Corporation on your team. Write or phone today to have a Planet "PV" engineer discuss your problem. Or send for Planet's free 88-page catalog . . . there's no obligation, of course.

PLANET
CORPORATION

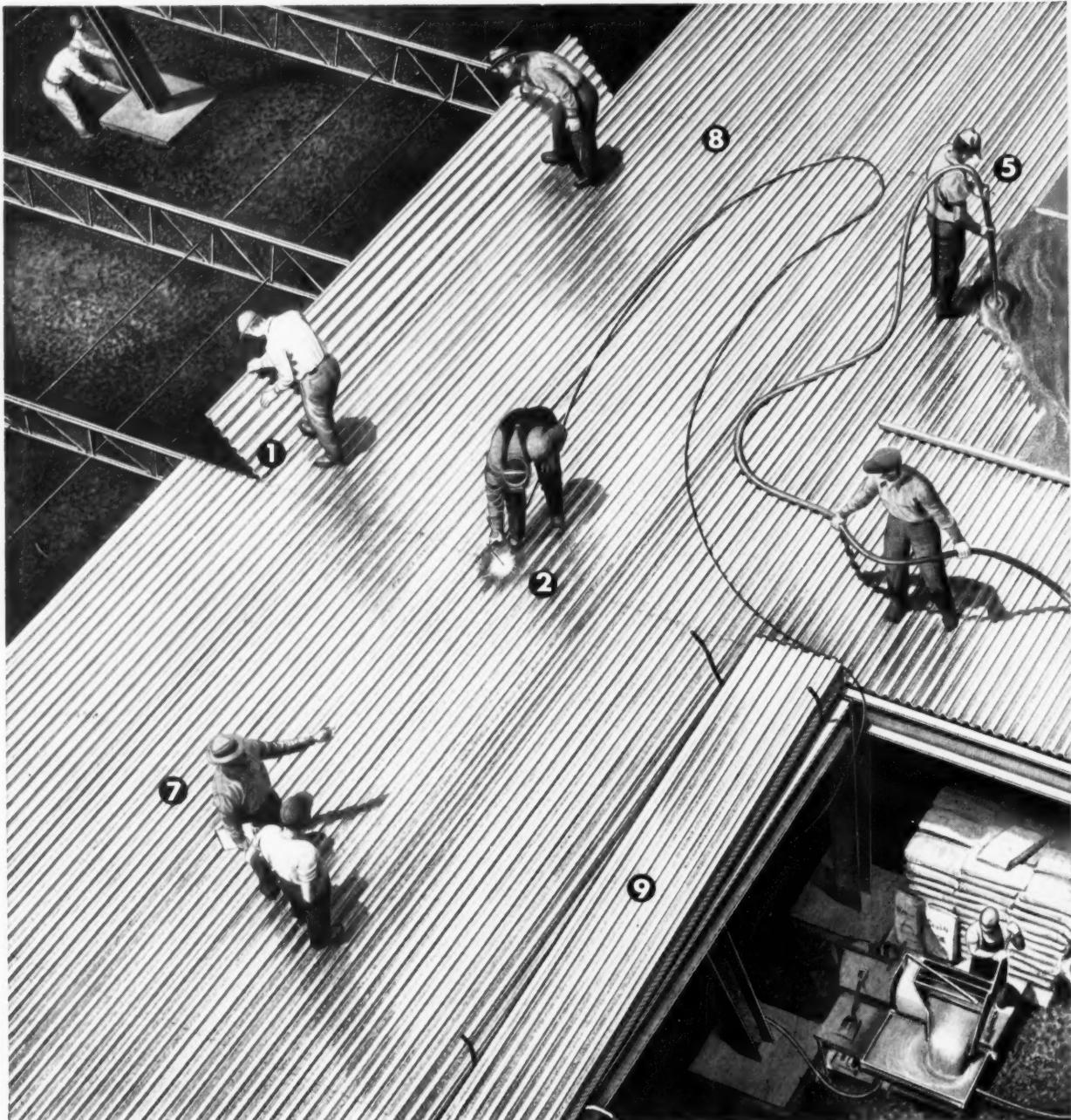


- ENGINEERED HANDLING SYSTEMS
- AUTOMATION EQUIPMENT
- FOUNDRY HANDLING SYSTEM

1823 SUNSET AVENUE
LANSING, MICHIGAN

91

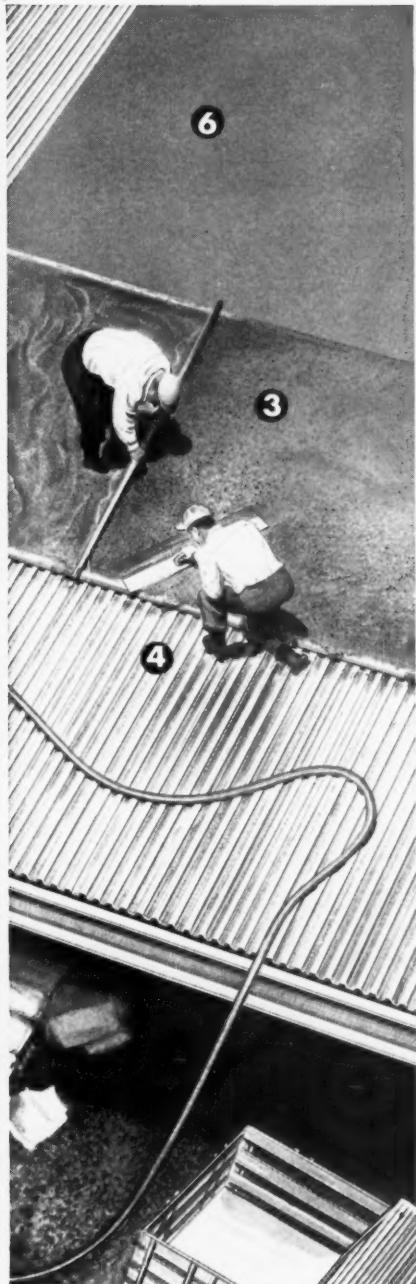
How a Tufcor® roof system



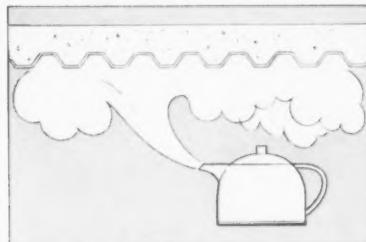
CHECK THESE TUFCOR FEATURES ▶

- ① **EASY TO INSTALL.** Rigid sheets fall quickly in place, arrive at job in convenient bundles.
- ② **FAST PLUG WELDING.** Long 21'6" sheets cover up to 48 sq. ft., mean fewer laps and welds.
- ③ **GREATER STRENGTH.** Tufcor roof system provides safety factor of 5 to 10 times design load.
- ④ **SAFE WORKING PLATFORM.** Trades move in as soon as sheets are welded in place. No planking needed.
- ⑤ **FAST PLACING OF INSULATION.** As quickly as placing sheets! Less labor. Faster job completion.
- ⑥ **FIRM ROOF BASE.** Rigid system provides flat base for built-up roof, speeds roof application.

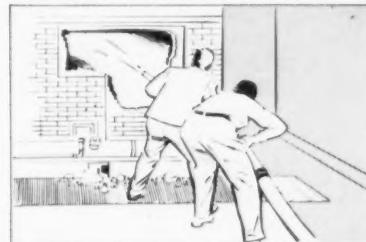
saves money in every stage of construction



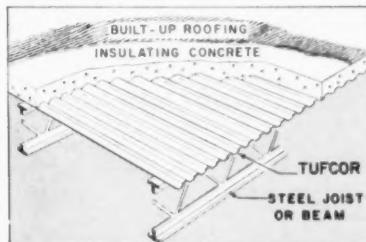
Check features. Compare with other systems. You'll see why Tufcor provides the lowest-cost roof assembly available. Construction is finished in three steps: (1) place Tufcor; (2) pour insulation; (3) apply built-up roof. Many qualified lightweight insulation applicators are now available to do an expert job. Consider, too, services you get from the producers of Tufcor. Granco pioneered in developing present-day floor and roof systems... maintains continuous research to keep its engineers, salesmen and distributors up-to-date on roof construction techniques. Like more information? Simply mail the coupon below.



VAPOR BARRIER. Tufcor prevents penetration of warm, moist air, keeps insulating concrete dry and effective. No wall vents or ceiling insulation needed. Heating and air conditioning costs are reduced.



FIRE-RESISTANT. No combustible materials in a Tufcor system! Exposed deck has a UL fire-resistant rating. Compare insurance savings over other systems. Tufcor saves on sprinkler heads, too.



ROOF SYSTEM MEETS ALL NEEDS... strength, insulation, permanence, fast, economical construction. System weighs 4 to 6 psf less than most types of roof construction, saves on structural framing.



QUICK AVAILABILITY. More than 100 Granco stocking distributors, located from coast to coast, assure you of fast, dependable delivery and immediate, experienced field assistance.

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FLOOR AND ROOF SYSTEMS FOR EVERY TYPE OF FRAMING

Granco Steel Products Co., 6506 N. Broadway, St. Louis 15, Missouri
A Subsidiary of GRANITE CITY STEEL COMPANY

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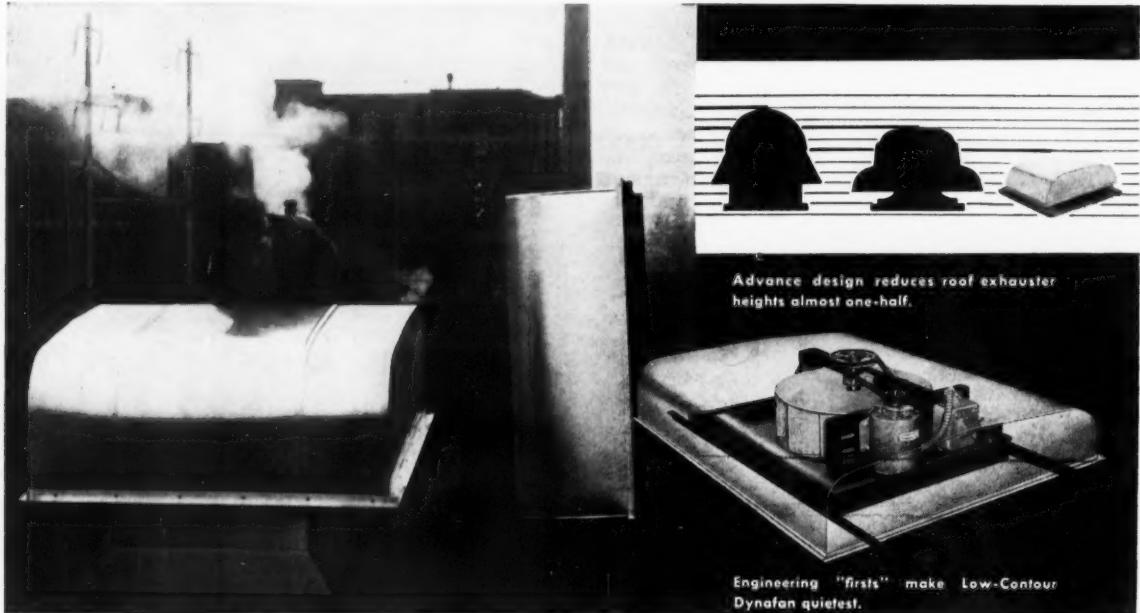
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- 7 **ONE APPLICATOR.** One firm places Tufcor and insulation. Fewer job phases to coordinate. Fewer delays.
- 8 **GALVANIZED SHEETS.** Permanent. No painting. Minimum maintenance. Under-side stays attractive.
- 9 **FULL LINE.** Tufcor is available in 26, 24, 22, 20, and 18 gage to span any structural layout.

LOW...
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QUIET



Penn Ventilator's new Low-Contour Dynafan hugs the roofline . . . hardly makes a sound. It's engineered specifically to run quietly. This new unit is your assurance that clean lines designed into modern buildings won't be compromised. Many engineering advances have been incorporated in the Low-Contour Dynafan. For example:

- motor isn't atop the wheel as in most roof exhausters
- there's no vibration-prone overhung shaft
- noise is cut appreciably by straddling
- fan wheels are supported between sealed ball bearings—above and below wheels
- entire fan floats on vibra-sorb vibration eliminators
- exact type motor to fit each particular service condition

Get all the details. Call your Penn Ventilator man or write to Penn Ventilator, Philadelphia.

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Representatives and Distributors in Principal Cities
Charter member of AMCA

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ATLANTIC CITY ELECTRIC CO. (2 Pla	BALTIMORE GAS & ELECTRIC CO. (4 Plants) •
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IOWA POWER & LIGHT CO. (2 Pla	KANSAS POWER & LIGHT CO. (4 Plants)
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SO. CAROLINA ELECTRIC & GA	SO. CALIF. EDISON CO. (6 Plan
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TEXAS ELECTRIC SERVICE CO. (3	TEXAS POWER & LIGHT CO. (3
TOLEDO EDISON CO. (2 Plants)	UNITED ILLUMINATING CO.
UTAH POWER & LIGHT CO. (2 Plants) •	VIRGINIA ELECTRIC & POWER CO. (4 Plants)

Model MP-3000 shown is for both new and old boilers having pressures to 3000 psig. Also available in Model MP-900 for boiler pressures to 900 psig.

8266

Undoubtedly the best recommendation for the Diamond "Multi-Port" Gauge is the public utilities that use it and have placed repeat orders to equip additional boilers. A few of these are mentioned here with a note of the number of plants equipped. For the many advantages of the "Multi-Port", ask your local Diamond office or write directly to Lancaster for Bulletin 1174 (Model MP-3000) or Bulletin 2044 (Model MP-900).

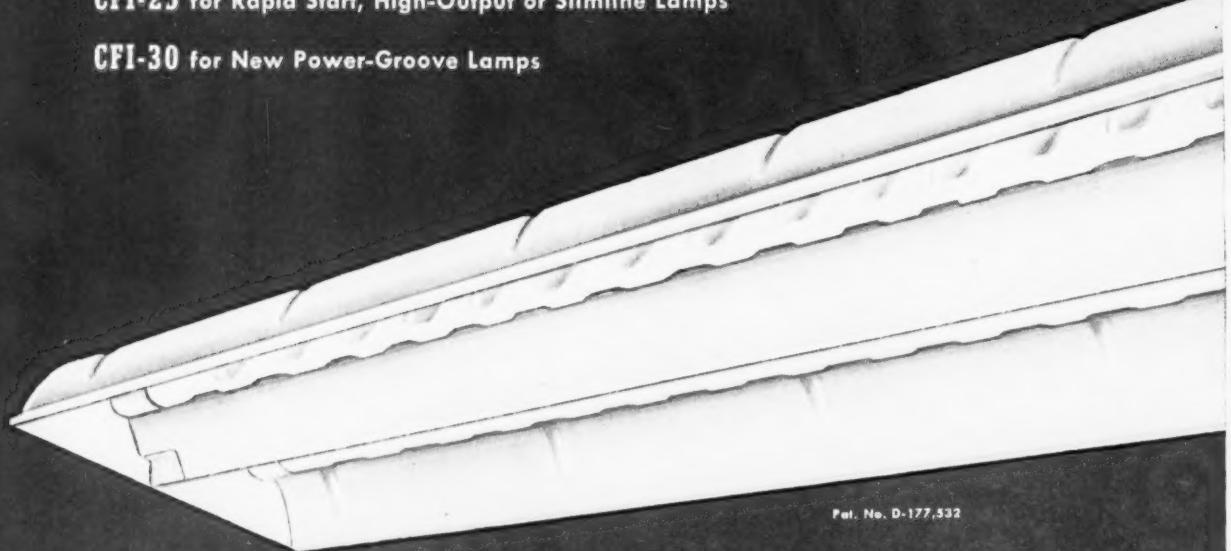


*Now your Industrial lighting dollar buys
up to twice the light with...*

DAY-BRITE'S NEW CFI®

CFI-25 for Rapid Start, High-Output or Slimline Lamps

CFI-30 for New Power-Groove Lamps



Pat. No. D-177,532

Day-Brite announces “OPERATION UPLIGHT”

IN 1952—Day-Brite introduced Comfort For Industry with CFI lighting fixtures having slotted reflectors.

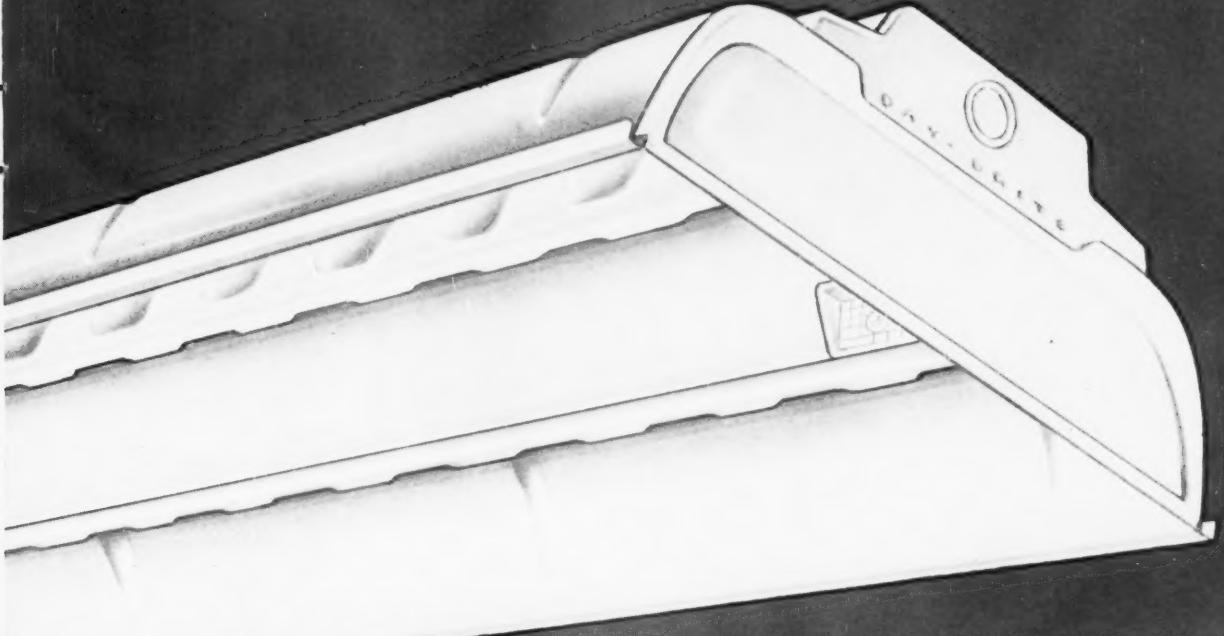
IN 1955—Day-Brite lowered installed costs for quality industrial lighting with improved CFI equipment.

TODAY—tests prove that industrial fixtures having 25% upward components and greater shielding provide more light...with greater eye comfort...at lowest installed and total owning cost...for all industrial lighting applications. OPERATION UPLIGHT is the result of these findings.

With OPERATION UPLIGHT, Day-Brite has now standardized its production of industrial fixtures on a basic, high uplighting design. Production savings are being passed along to buyers in **PRICE REDUCTIONS AMOUNTING UP TO 17.7%**.

Now one basic fixture, available in two adaptations for different lamps, delivers comfort lighting at lowest cost for *any* industrial application. Today's lower-priced Day-Brite CFI-30 fixture, used with new Power-Groove lamps having an output of 15,000 lumens, actually reduces the cost of lighting many industrial areas as much as 54%.





25% uplight washes out harsh ceiling contrasts

• "Up-draft" action provides more efficient self-cleaning • Center "V" and closed ends for added shielding and strength • Reflection surfaces are lifetime porcelain enamel for easy cleaning • 8-foot rigid channel, one-piece reflector for simplified installation • Spring-loaded sockets hold lamps securely, speed relamping • ALL THIS AT UP TO 17.7% LOWER COST!

UPLIGHT for higher lighting levels at lower cost

New lighting standards adopted by the Illuminating Engineering Society approximately double footcandle levels previously recommended. It is estimated that between 90 and 95% of existing lighting installations are now outdated.* And now, OPERATION UPLIGHT gives owners of industrial lighting systems these new reasons for relighting—without delay:

UPLIGHT for lower installed cost.

Day-Brite CFI-30 fixtures with new Power-Groove lamps reduce installed cost per square foot by as much as 54% because fixture prices are lower...and fewer fixtures are needed. And installation costs are also reduced because CFI equipment is designed to go up faster...with fewer parts to handle...and line up more easily.

UPLIGHT for lower operating cost.

The Taylor-Bradley research establishes new maintenance factors for industrial lighting...proves that Day-Brite CFI-25

fixtures lose 44% less light output due to dust and dirt during 30 months' operation than units having solid top reflectors.

UPLIGHT for lower annual owning cost.

Day-Brite CFI-30 fixtures with new Power-Groove lamps reduce total annual owning cost by up to 30% compared with other fluorescent or mercury vapor systems...and by 91% compared with incandescent lighting.

PLUS...A BIG BONUS IN COMFORT.

Day-Brite's new CFI fixture not only delivers more light on the work plane, but also reduces eye strain and fatigue. Upward lighting balances brightness. Center "V" louver and fully enclosed ends (previously an extra cost feature on the CFI-25) help cut glare.

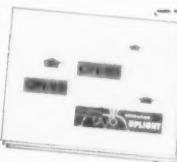
*ELECTRICAL CONSTRUCTION AND MAINTENANCE, NOV., 1958

This booklet tells how plant owners can save money through OPERATION UPLIGHT. For your copy, call your Day-Brite representative listed in the Yellow Pages. Or mail this coupon today.

A-119 © 1959 by Day-Brite Lighting, Inc.



DAY-BRITE LIGHTING, INC.
St. Louis, Mo. • Santa Clara, Calif.
NATION'S LARGEST MANUFACTURER OF
COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT



Day-Brite Lighting, Inc.

6256 N. Broadway
St. Louis 15, Missouri

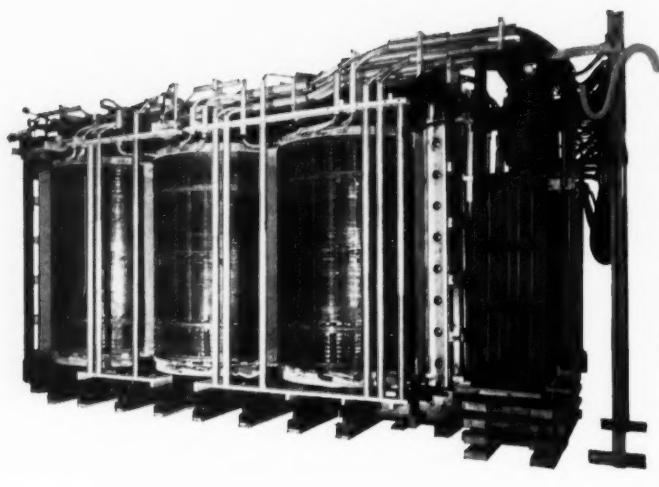
GENTLEMEN: Please send me your free booklet on "Operation Uplight."

Name Title

Firm

Address

City Zone State



The completed core-and-coil assembly showing the main, series and reactor transformers.

Note the substantial framework, the method of insulating and supporting the leads and the quality of workmanship, all of which are inherently a part of Moloney transformers.



Recently shipped to Consolidated Edison Co., of New York: two 100,000 KVA, 138 KV transformers designed to maintain proper voltage on the Consolidated Edison, Staten Island System

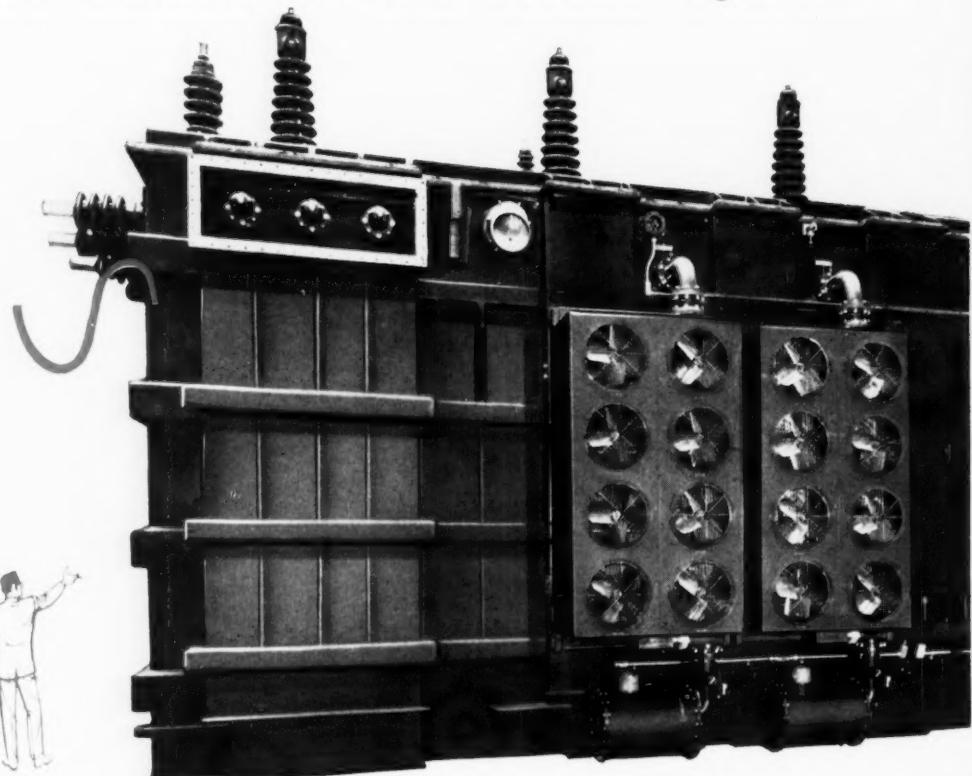
Low voltage side of a three phase, 60 cycle, LTC transformer, type OA/FA/FOA rated:

60,000/80,000/100,000 KVA

-High Voltage:
132,000 Volts

-Intermediate Voltage:
35,000Y/20,200 Volts

-Low Voltage:
13,800Y/7960 Volts at
12,000/16,000/20,000 KVA



**These Tie
Feeder Transformers
for Consolidated Edison's
Arthur Kill Generator Station,
Unit #2 located on Staten Island
will be connected to the
Consolidated Edison System
by 138 KV cables under
the narrows to
Brooklyn, N. Y.**



These units are 60,000/80,000/100,000 KVA, three phase, sixty cycle, type OA/FA/FOA transformers rated as follows: high voltage 132,000 volts, intermediate voltage 35,000Y/20,200 volts, low voltage 13,800Y/7960 volts at 12,000/16,000/20,000 KVA. They are equipped with load tap changing equipment in the 35 KV intermediate winding for plus or minus 12% regulation to provide regulated voltage for the Staten Island load.

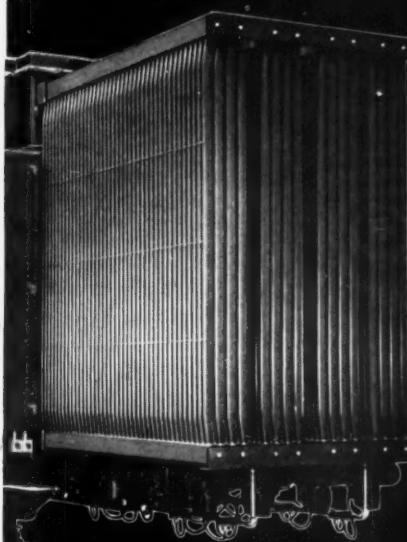
The 13.8 KV winding is designed to provide start-up auxiliary power for Arthur Kill Generating Station, Unit #2, which has a rating of 335 MW. To stabilize the voltage of the intermediate winding due to this start-up load on the low voltage winding, a zero or slightly negative impedance is utilized in one branch of the equivalent impedance diagram.

Due to the complexity of this design, Moloney built and tested a prototype to obtain the best possible design. The tests conducted on the prototype included tests to determine surge voltage distribution and impedance.

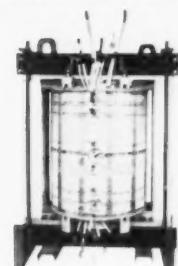
Another feature of these units, which was specified by the Consolidated Edison Company, is that they have a sound level considerably below the standard NEMA level.

Moloney Power Transformers are available in all voltage and KVA ratings in special or in standard designs. Contact your Moloney representative for information on any size or type transformer . . . Specify Moloney Transformers . . . All Along the Line.

ME-51



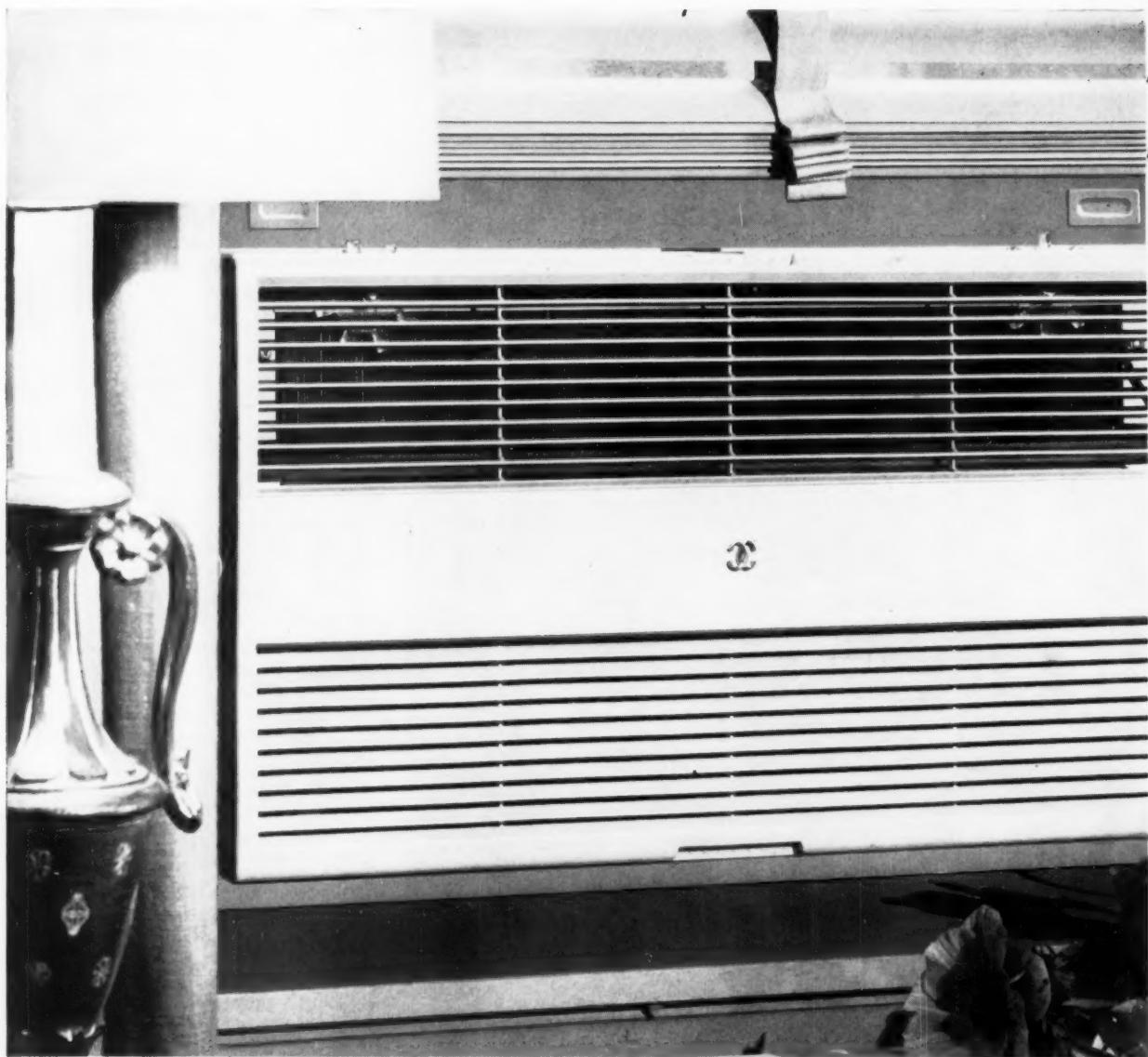
MOLONEY ELECTRIC COMPANY



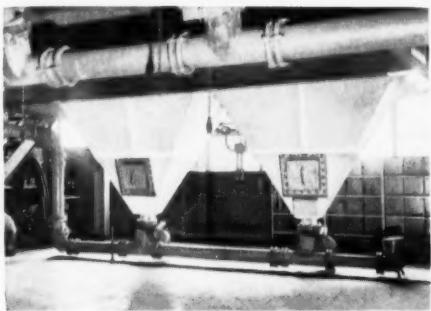
Prototype of
windings, used
to determine
surge voltage
distribution
and impedance.

*Manufacturers of Transformers for Utilities,
Industry, and Electronic Applications*

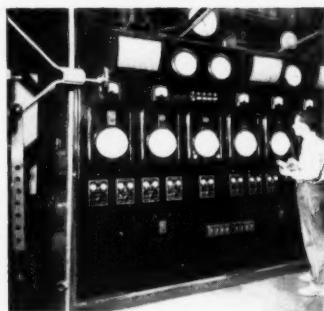
**SALES OFFICES IN ALL PRINCIPAL CITIES
FACTORIES AT ST. LOUIS 20, MO.,
AND TORONTO, ONT., CANADA**



General view of Carrier power plant. Boilers on right are bent tube, two-drum types, by Riley Stoker Corp., burning pulverized coal. Coal moves from bunkers to Riley Pulverizers (at left in photo) and then into furnace.



Mechanical dust collectors by Prat-Daniel Corp. help assure cleanliness of operation. These collectors tie in with United Conveyor ash handling system for movement to ash silo and final disposal.



Pneumatic automatic control panel by Bailey Meter Co. regulates combustion operation of all boilers and auxiliary equipment, maintains continuing steam generation efficiency!

Carrier puts the chill on fuel costs...with coal

Air conditioner manufacturer uses coal for low-cost steam

An unusual team—the heating ability of coal and the cooling facility of air conditioning equipment! Yet Carrier Corporation, Syracuse, N.Y., found this combination profitable when expansion plans required additional capacity in its steam plant. After engineering surveys, Carrier decided to continue burning coal for economy of operation. Today modern power equipment supplies steam *economically* for heating, air conditioning and processing. Original fuel costs plus automatic operation within the power plant hold overall steam costs to a minimum.

Coal is lowest cost fuel

Today, when the annual cost of fuel often equals the original cost of the boilers, you should know that bituminous coal is the lowest cost fuel in most industrial areas. And modern coal-burning equipment gives you 15% to 50% more steam per dollar, while automatic operation trims labor costs and eliminates smoke

problems. What's more, tremendous coal reserves and mechanized mining procedures assure you a constantly plentiful supply of coal at stable prices.

Technical advisory service

All companies planning a new power plant, or the remodeling of a present one, should consult an engineering firm on its design and construction. As a matter of fact, every Bituminous Coal Institute advertisement advises its readers to take this step. When you have such a project, our Engineering Staff will be glad to assist you in your fuel cost survey with any coal information you may require.

Send for FREE booklet

Meanwhile, we believe you will be interested in our informative case histories booklet, complete with data sheets. Send coupon below for your copy.

BITUMINOUS COAL INSTITUTE

Dept. CE-04, Southern Building, Washington 5, D. C.

See our listing in SWEET'S

SEND COUPON FOR NEW BCI PUBLICATIONS.
Guide Specifications, with complete equipment criteria
and boiler room plans:



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Gentlemen: Please send me:

CE-04

- GS-1 (low-pressure heating plant, screw-type underfeed stoker); GS-2 (high-pressure heating and/or process plant, ram-type underfeed stoker); GS-3 (automatic package boiler for heating and process plants). Case histories on larger plants.

Name _____

Title _____

Company _____

Address _____

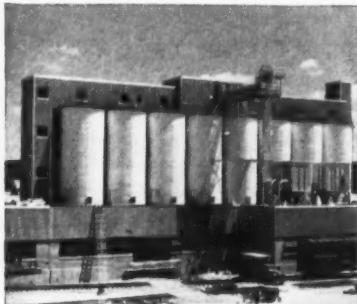
City _____ Zone _____ State _____



Coal is loaded into silos before it moves to bunkers. At left is the ash silo which utilizes rotary dustless unloader in loading trucks for disposal. Silos and conveyors are by Fairfield Engineering Co.

**Step-up Storage efficiency,
cut Materials losses**

with *Marietta*
concrete silos



For ceramic materials storage

A Marietta concrete silo system saves you time, money and labor. Any type of mechanical or pneumatic conveyor or filling and discharge method can be used with these silos. Whatever system you choose can be mounted directly, safely on the roof or side wall of a sturdy Marietta silo.

It will pay you to have expert Marietta engineers design the concrete silo storage system that best fits your needs. It's the best way to get the efficient, economical storage you want . . . reduce losses due to materials waste. Our staff will work closely with your consultants, contractors.

Write for your copy of the Marietta Modern Industrial Storage Systems booklet.

Only Marietta offers four types of concrete staves . . . assures you the best construction for your requirements.

THE
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CONCRETE CORPORATION
MARIETTA, OHIO

Branch Offices and Plants:
• Baltimore 21, Md.
• Charlotte 6, N.C.
• Jamestown, N.Y.



Readers' Comment

The Appian Way

Sir:

May I compliment you on both the January and February issues. They are both excellent in appearance and contents.

I was particularly interested in the article "Concrete Construction in Ancient Rome." It is unfortunate that the authors made no mention of the construction of the most famous of all Roman roads, the queen of all ancient roads, the Appian Way. The specifications for its building forms one of the oldest engineering specifications on record. For this we have to thank Julius Caesar who mentions it in his *Commentaries*.

Claudius Appius built this famous road about 312 B.C.; it extended from Rome to Capua. As a warrior and Solon he realized that good roads were of prime importance for the movement of troops as well as to move supplies into and from large civilian centers of population. More than two centuries later, Julius Caesar extended it to Brindisi and enlarged it from 16 feet to 32 feet. His specification for its construction is a gem. He called for the road to be about 3-ft deep. The foundation, or "statumin," was formed by embedding large flat stones in a cementing mortar. Above this was the "rodus," or hand sized rock or gravel, laid in mortar; and finally

a layer of "summa crusta," a slab of flat stones closely joined.

The Romans were the first to make use of pozzolana, a type of volcanic ash found near the city of Pozzouli. Since this ash is very similar to our ground cement clinker, when mixed with water it makes a product similar to our concrete. So, in a manner of speaking, the Romans were the inventors of calcined limestone and what corresponds to our portland cement.

Leo Dolkart

Consulting Electrical Engineer
Chicago, Illinois

Request Granted

Sir:

As you know from previous correspondence, I am very pleased to be receiving your magazine and I will reaffirm previous statements to the effect that I feel that your coverage, both editorially and advertising-wise, is on a very high plane. I have heard many favorable comments from other engineers along the same vein.

The main purpose of this letter, however, is to respectfully request that you compliment Mr. Thos. desFurman, Associate Professor of Electrical Engineering, University of Florida, Gainesville, Florida with a subscription to your magazine. I have had occasion to discuss this matter with Professor desFurman several times and I know that he

EXACTLY THE PANELBOARD YOU WANT

Right Off Your Square D Distributor's Shelf!



In our contracting business, we find QMB PANELBOARDS are just the thing for heavy industrial jobs. The switches are heavy-duty horsepower rated and they plug in just like plug-in duct units or drawout air circuit breakers. The switch unit I'm holding is a twin 60 ampere 3-pole unit, rated 600 volts. We picked up the entire panelboard this morning from our local Square D distributor's stock to use on a 480 volt job. *We'll have it installed and wired by tomorrow afternoon—and no overtime.*

Notice that this 240 volt switch is much smaller than the 600 volt unit. That means we can put more circuits in the same size panelboard. Since Square D started making these new smaller units, we've been using QMB on all our commercial jobs. The interiors and boxes are the same for both 240 and 600 volt panelboards. That means one stock can work for both. *We can get the complete panelboard from our local Square D distributor the same day the job develops.*

We don't gang separate safety switches and motor starters over a trough any more. The new QMB MOTOR STARTER PANELBOARD makes a much cleaner job. It's easier to install, it costs no more, and it's in our distributor's stock. In our business, we're concerned with overall installed costs. We find the installed cost of the QMB STARTER PANELBOARD is no greater than that of separate components. The interlock between the switch and starter doors makes a much safer installation, too.

- Plug-in construction combined with heavy-duty industrial design has made the QMB PANELBOARD a tremendous success. In fact, the flexibility of this unit plus availability from distributor stocks, has made it the leading power panelboard on the market. It's available either in 600 volt or 240 volt construction. Motor control units are available for use with either voltage switch units. When switch units exceed 200 amperes, the panelboards can be obtained from the nearest Square D Assembly Plant, completely factory-assembled. It's the modern fusible standard.

*For additional information
write Square D Company, 6060 Rivard Street, Detroit 11, Michigan*

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY



has used articles from your magazine in the past in the classroom and if he had full access to the magazine, it would serve a very useful purpose and would be available to a large number of readers.

Harold D. Briley, President
Florida Engineering Society

Firm Organization

Sir:

Your magazine has provided extremely valuable information of

specific interest to the consulting engineer, information which is available nowhere else. I would like to congratulate you on the service you are rendering to the profession and at the same time pass along a suggestion for a survey, the result of which, I believe, would be of great interest to many of your readers.

Past issues have had articles concerning the organizational setup of several large consulting engi-

neering firms. It would be of great interest to me, and I am sure to others, to know the several ways which other firms of all sizes are organized. As an example, I can see that in my own area there are firms of various organizational arrangements. There are two- and three-man firms where the principal acts as engineer, executive, specification writer, personnel manager, and controller, and works in conjunction with one or two draftsmen. There are extensions of this arrangement whereby there are several principals, each acting as a head of a three-man organization as described above, but where all principals are associated to form a single firm.

In contrast would be the highly departmentalized large office described several times in your magazine, where instead of two levels of organization there are many levels of responsibility and high departmentalization. There are other examples which could be cited, but I am sure I have passed along the idea.

Michael Best
Kravolec & Best
Chicago, Illinois

Private Enterprise

Sir:

I have read various articles in the past concerning the build-up of government engineering staffs — local, state, and Federal — and recently read the comment published in the February issue by Anonymous on Highway Department Empires. All of these articles have brought out good arguments, as have the rebuttals.

One point that never has been mentioned to my knowledge, or at least in the articles I have read, is the over-all economics in the theory of building up various governmental agencies, be they engineering, construction, or managerial. The point is this — if the governmental agencies are continually built up over the years so that they can do most of the work



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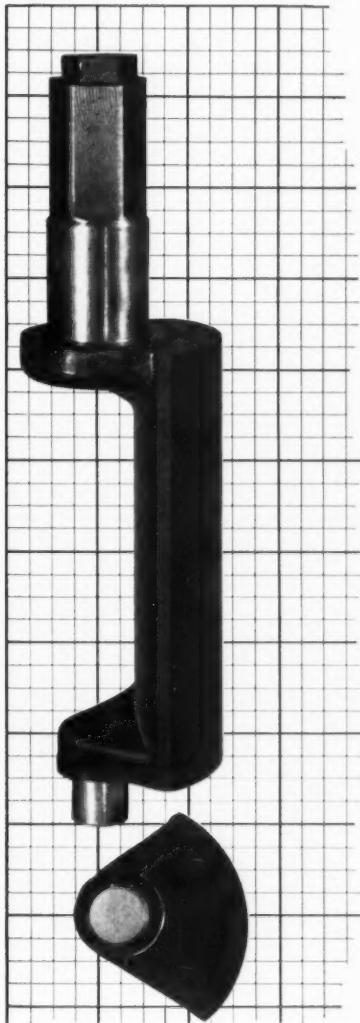
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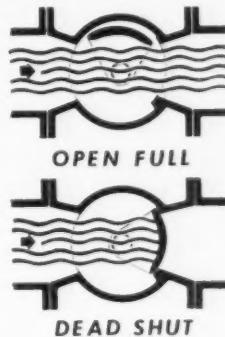
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needed on governmental projects, thereby replacing to a very large degree the need for private enterprise in these projects, the taxes paid to the government by private enterprise are going to dwindle, throwing that much more of a burden upon other taxpayers. I will grant the opposition, to a degree, that it is possible for governmental agencies to do some or all work at a slightly lower figure than private enterprise — but only be-

cause the governmental agencies do not have to show a profit to stockholders; and in most instances, if not all, do not have to include cost of "taxes" that normally would have to be paid if private enterprise were doing the same work — at some profit.

I believe that this trend eventually will lead to a socialistic state; whereas, on the other hand, if the governmental agencies were reduced to "overseers" on govern-

mental projects and the services performed by private enterprise, the over-all tax base would be improved with more taxable income, corporate and individual.

I am a firm believer that the government should undertake only those jobs that private enterprise cannot do or will not do. Certainly most engineering cannot be included in that category.

May I add also that I worked for a city engineering department when first out of school and did find that the underlying reason for wanting to do most of the work with city forces, where private enterprise could have done it, was the simple individual satisfaction of being able to do it ourselves. I was guilty of the same feeling. Possibly this is the main reason for the build-up of personnel in various governmental agencies — pride of accomplishment.

Harry S. Thayer,
Design Engineer
Foth & Porath, Inc.
Green Bay, Wisconsin

• GOVERNMENT ENGINEERING VS.
PRIVATE ENGINEERING IN NEW YORK
STATE IS DISCUSSED IN FIELD NOTES,
STARTING ON PAGE 142.

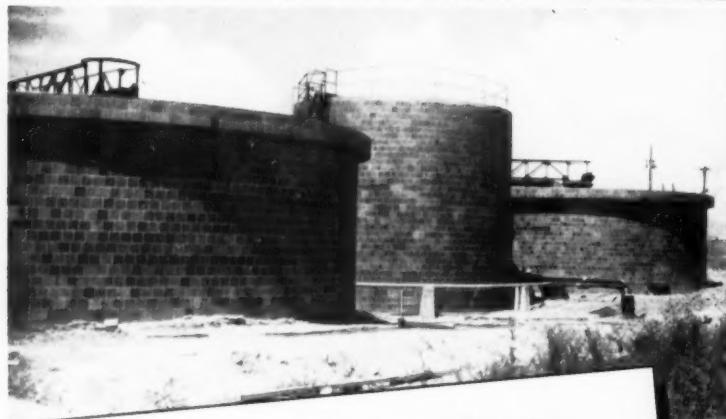
Lublin, McGaughy Case

Sir:

What especially flagged my attention in your February lead article was the court decision in Mr. McGaughy's case, namely, requiring him to bring his minor employees under the Wage and Hour Law. I regret this decision exceedingly.

I also deplore the legal fixation of hourly maxima, minimum hourly rates, and premium pay for time over the prescribed amount — for any and all classifications of employees. Such factors have an adverse effect on esprit de corps, make the job of management more difficult, and foster inflation. Mr. McGaughy well observes that now his hourly personnel are more interested in collecting premium pay for overtime than formerly, as salaried, in qualifying for a bonus.

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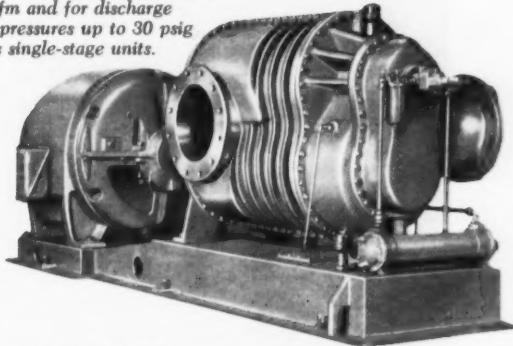
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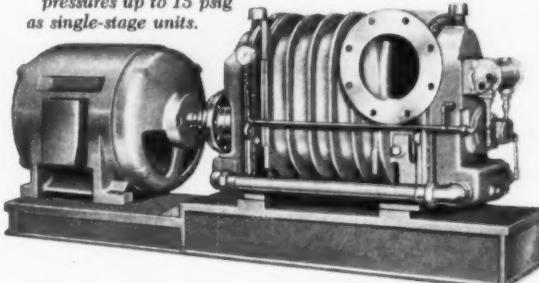


For additional data,
please refer to
pages 565-568 in
Chemical Engineering
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The famous R-C Spiraxial® Compressor is now offered in two pressure ranges — both with increased efficiency and higher ratings.

The Type LAL for pressures to 30 psig has been serving efficiently and economically in a wide variety of applications. Its *efficiency* and *economy* have been proved by 24-hour service for months on end at oil refinery installations. The unit has helped increase throughput to such an extent that one-year's run will pay for the installation.

With the new lower-pressure Type LAH for pressures to 15 psig, the efficiency and economy of R-C Spiraxial Compressors can now be gained in many new applications. Its *dependability* has been proved by its use in nuclear-powered submarines for ventilation exhaust and ballast blowing. Either Type LAL or LAH can be employed in parallel operation to increase capacities indefinitely.

The ability of Spiraxial Compressors to deliver oil-free, uncontaminated air or gas makes them ideal for such applications as aeration and agitation of fermentation vessels, pneumatic conveying, catalyst regeneration, process oxidation and many others.

The Spiraxial design which makes possible this broad range of applications is the result of R-C's specialized experience of more than 100 years in the design and application of air and gas handling equipment.



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That has been my observation, too — incentive is keyed negatively so that in periods of stress men actually conspire to drag out the duration of the work in order to compel more paid overtime.

The lesson I draw from Mr. McGaughy's experience, as well as my own, is that we professional men must get into politics, be as active as are the labor and farm organizations. We may well take our cue from recent developments in the

manufacturing field where many companies have come out bluntly for such participation as the best way to counter organized labor and effect an amelioration of existing laws. As I see it, our very future as a free and prosperous society hangs in the balance.

I also am in agreement with Mr. McGaughy in having a decided predilection toward the architectural-engineering combination, only I would put "engineering" first. I be-

lieve that the engineer, if measuring up to his full function, should predominate over the architect, save only in exceptional cases where the architect is outstanding and is a pretty good engineer himself.

Harry Franklin Porter
Consulting Engineer
Glastonbury, Connecticut

The Professional Engineer

Sir:

Recently, in one of our professional society publications, an officer stated that it would certainly help us to advertise the profession if we always remembered to add "P.E." after every signature.

I have done this ever since I obtained my license. I chose to do it the hard way, rather than try to beat the deadline on the grandfather's clause, which I easily could have done. I am, therefore, proud of the "P.E." I suggested that our local and state officers recommend that we always use it, and they agreed that it would be a good idea. They then promptly forgot about it.

Here we are, recommending that we hire publicity men to make the public realize that we are a professional group — we usually use the simile "like doctors and lawyers." I think we might well get whatever minor degree of publicity we can out of the use of our "title." I have, as I said, always used "P.E." after my name in my signature, as below. Answers received from some of my correspondence have called me "Project Engineer," "Production Engineer," "Promotion Engineer" (heaven forbid), and anything else but the proper designation—Professional Engineer.

Now I notice that your addressograph plates apparently suffer from the omission of "P.E." also. May I suggest that "P.E." be added to my name, and to all others on your circulation list who should have the honor.

Lee F. Bernhardt, P.E.
Chief Engineer, "Design"
Fort Wayne, Indiana

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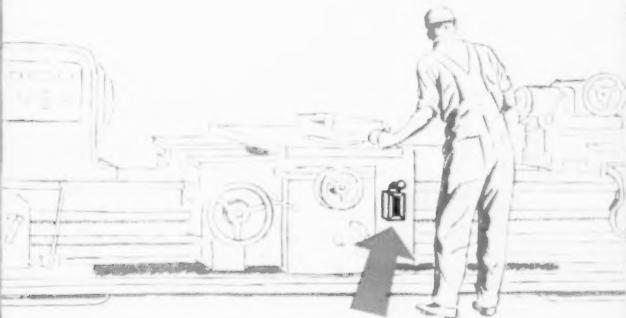
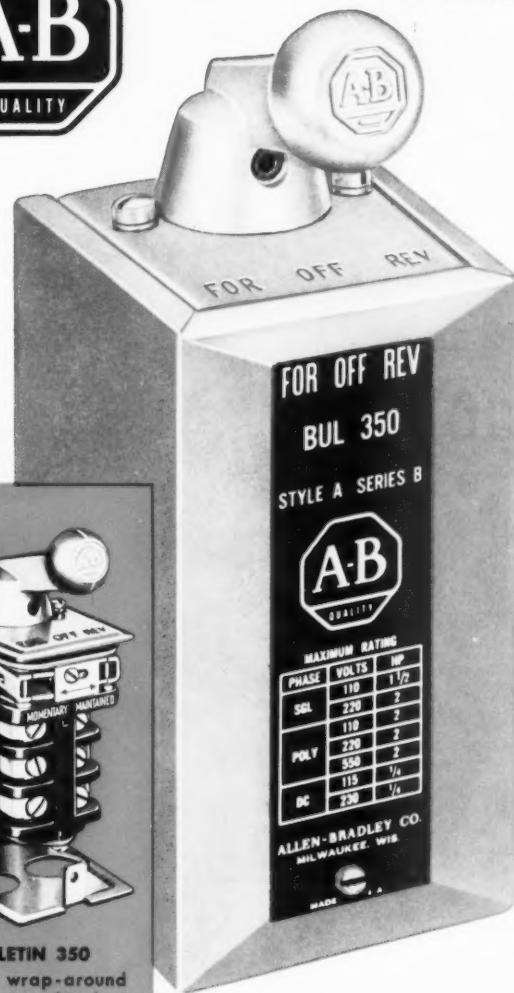


ALLEN-BRADLEY REVERSING DRUM SWITCHES



BULLETIN 350

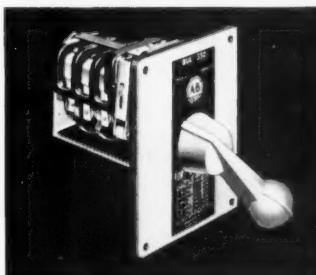
Style A wrap-around cover is removed to show the readily accessible front wiring terminals. Max rating: 2 hp.



...styled to match the most modern production machines!

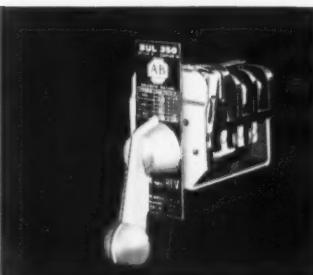
Inside and out—this Allen-Bradley drum switch is *all* new. Its trim, modern lines and attractive die-cast aluminum handle will give your production machines "up-to-the-minute" styling.

But there is more than beauty to this new switch. The rugged switch mechanism is a self-contained unit—*independent* of the enclosure. Misalignment and binding *cannot* occur. The base mounts directly on machine surfaces—without using spacers. And with the wrap-around cover removed, terminal screws are exposed for fast wiring—from the front. Changeover from momentary to maintained contact operation can be made in seconds. Investigate this new "leader" in its field. Send for Publication 6091.



OILTIGHT CAVITY MOUNTING

A-B Style AF reversing switches can be furnished with sealed shaft and rubber-gasketed, oiltight cover for cavity mounting in a machine base.



PANEL MOUNTING

The new Style A switches can be furnished for mounting directly on panels. Nameplate which gives ratings is also included with each switch.

ALLEN-BRADLEY

Quality Motor Control

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.



Reversing Drum Switch for across-the-line starting and reversing a-c and d-c motors. Interlocks available. Bulletin 350. Max ratings: A.C. 20 hp, 220 v; 40 hp, 440-550 v. D.C. 3 hp, 115-230 v.



Multi-speed Drum Switch for starting, speed changing, and reversing of multi-speed squirrel cage motors. Bulletin 365. Max ratings: 75 hp, 220 v; 150 hp, 440-550 v.



Speed Regulating Drum Switch for starting and regulating duty of wound-rotor motors. Bulletin 375 non-reversing. Max ratings: 500 hp, 220-440-550 v. Bulletin 385 reversing. Max ratings: 60 hp, 220 v; 75 hp, 440-550 v.



For years of dependable performance
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These Allen-Bradley drum switches provide simple and economical control for alternating current motors. Although low in cost, these unusually rugged switches are built under Allen-Bradley standards of *quality* . . . your assurance of reliable, trouble free performance. And this broad line of drum switches offers a variety of mounting types, operating handles, and interlocks to satisfy practically every requirement. Let us send you details on this versatile line of drum switches.



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Arctic Engineering

(page 100)

With most consulting engineer firms operating as rather small, personally owned organizations, it is only natural that they should be slow to adopt many of the modern management concepts quite generally accepted by large corporations. It is customary for consultants to complain, especially in June, that young engineering graduates are not what they used to be. All they are looking for is security! There is more than a grain of truth in this, and the young graduate is properly condemned for not being able to see the forest of opportunity for the trees of security, but this is not the whole story. It is claimed by many respected management authorities that some types of fringe benefits emphasize incentive rather than security, and the profit sharing plan is clearly in this group. Profit sharing plans have worked—and they have failed—but Slocum and Fuller, New York consulting engineers, now have a plan that they think is good. It has not been in operation very long, but both employers and employees like it. To find out how it works and what it could offer other firms, see Arthur L. Spaet's "Can Consultants Profit From Profit Sharing?"

Underground

Aqueducts

In Iran

(page 106)

Seldom have we read so interesting a travel story as Dick Harza's account of what he found at the bottom of Iran's qanats. Flying into that Middle Eastern country Harza noted line upon line of what appeared to be giant anthills. He was fascinated. He was in Iran on firm business (Harza Engineering Co.), but he found that in Iran patience is the better part of business acumen, so he spent much of his time investigating those qanats, the basis of Iran's fabulous irrigation system. What he found is fascinating for engineers and laymen alike. He tells about his experiences in "An Engineer Looks Under Iran's Giant Anthills."

In all the years between the dioptra of the Roman surveyors and the development of the modern transit, there were only two really basic improvements in surveying equipment. One was the telescope, the other the vernier, both invented in the early years of the 17th century. Now, 350 years later, another major development has been made. The surveyor's chain is being replaced by electronic devices operating on a radar principle. It is unlikely that these instruments will soon replace conventional methods for small surveys, and the young chainmen still will have to learn how to throw a tape, but these new surveying instruments offer enormous advantages for fairly long distances over rough terrain. The author of the article, "Radar Joins the Survey Party," Floyd W. Hough, has distinguished himself internationally as an expert in geodesy. Not only is he the top man in his field, he is also a consulting engineer—president of Geomatics, Inc.

The Readers' Guide

All the engineering handbooks seem to have been written by authors who lived in the temperate zones. No one has yet compiled a *Polar Engineers Handbook*, but when someone does, it will contain a lot of different data. To be specific, civil engineering work on airstrips and highways in the far North takes a very special knowledge of materials, soils, and drainage. The existence of a thick layer of tundra just under the surface completely changes the engineering picture, and the specifications given the contractor are quite the reverse of what is to be expected in more temperate climates. To get some idea of the peculiarities of the problems, turn to "Arctic Airstrips Call For Special Handling," by Stephen D. Teeter and Stanley Rosanoff, of Seelye Stevenson Value & Knecht.

How to Profit

From Profit Sharing

(page 110)

Cast off

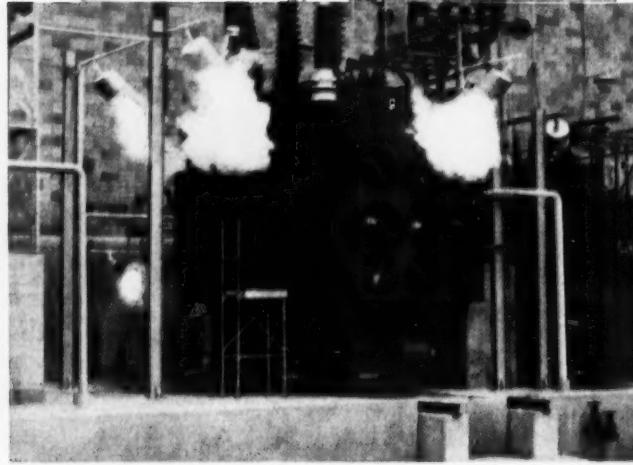
Those Chains

(page 118)



GLOBE SPRINKLER SYSTEMS

The Saveall Automatic Sprinkler, with a solid chemical fusible element, is available in upright or pendant types at various temperature ratings. Globe also makes chemical and standard metal fusible units, automatic sprinkler system maintenance devices, window and cornice sprinklers, spray nozzles, and dry pendant type sprinklers. Globe assumes full responsibility for proper design, materials, installation and performance of every system.

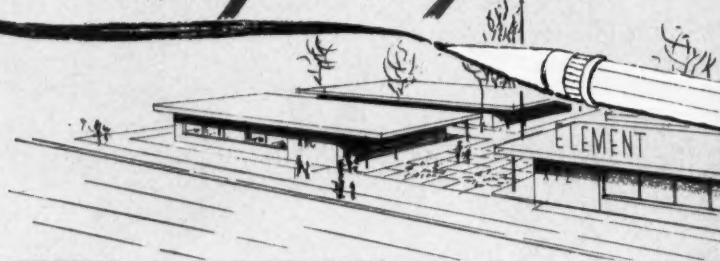


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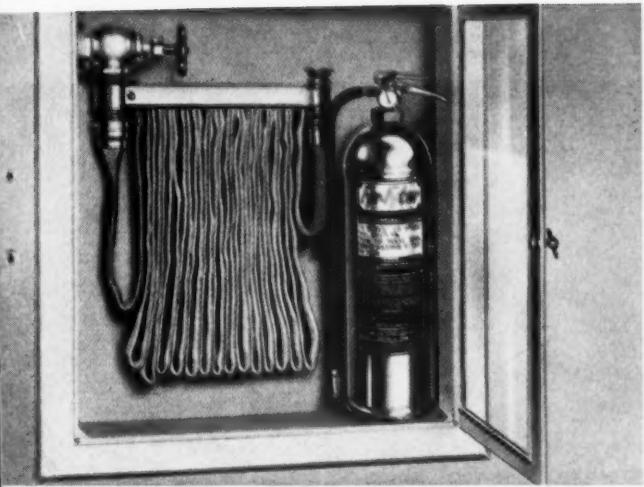
Fyr-Fyter, Pyrene-C-O-Two and Buffalo liquid-agent extinguishers are designed primarily for buildings where ordinary combustibles constitute the chief hazard. Available are clear water, anti-freeze, soda acid, loaded stream, foam and vaporizing liquid models, in sizes from $2\frac{1}{2}$ to 40 gal. Fyr-Fyter brand is sold through fire equipment specialty firms; Pyrene-C-O-Two and Buffalo through leading industrial distributors.



DRY CHEMICAL and CARBON DIOXIDE EXTINGUISHERS

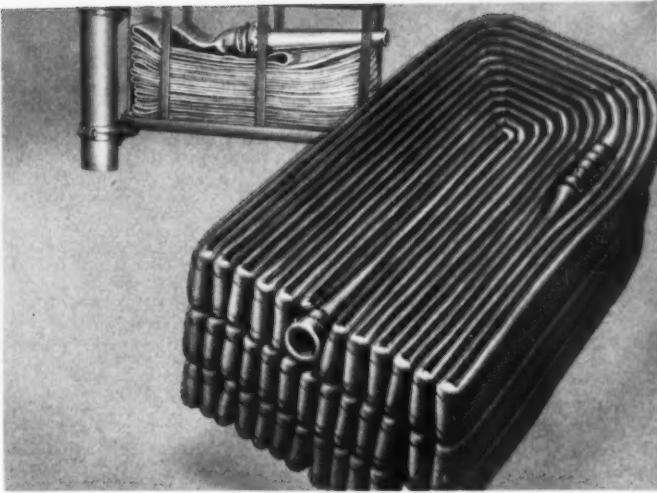
Where building hazards include flammable liquids and/or live electrical equipment, you can specify complete protection from this range of dry chemical extinguishers, $2\frac{1}{2}$ lb. to 150 lb., or carbon dioxide extinguishers, $2\frac{1}{2}$ lb. to 100 lb. Extinguishers of all three famous brands—Fyr-Fyter, Pyrene-C-O-Two and Buffalo—are approved by Underwriters' Laboratories and Factory Mutual and carry new, high U.L. ratings.





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Underwriters' and Factory Mutual approved, this equipment enhances any structure with its modern, attractive, confidence-inspiring appearance. Mass production permits competitive pricing. Yet highest quality and dependability are assured by rigid inspection, reinforced by Fyr-Fyter's reputation as the

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has been expertly rendered into a
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ALARMS

Exciting design ideas with POZZOLITH concrete . . .

MASTER
BUILDERS

Precast concrete roof is delicately scaled cantilevered folded-plate

The precast roof of the new American Concrete Institute headquarters building at Detroit, Michigan, is a striking example of modern POZZOLITH concrete design.

Because of the high performance requirements for this unusual cantilevered roof design, POZZOLITH concrete was used to produce the 46 precast roof sections. Twenty-eight day concrete strengths averaged 5100 psi—and significantly little finishing was needed to meet the architect's high surface-finish requirements.

Leading architects and engineers have found there's no equal to POZZOLITH for its proven ability to produce architecturally and structurally superior concrete at lowest cost in place.

On any current or future concrete projects, your local Master Builders field man will welcome discussing your requirements. Call him in. He's at your service—and expertly assisted by the Master Builders research and engineering staff—unexcelled in the field of concrete technology. Write us for complete information.

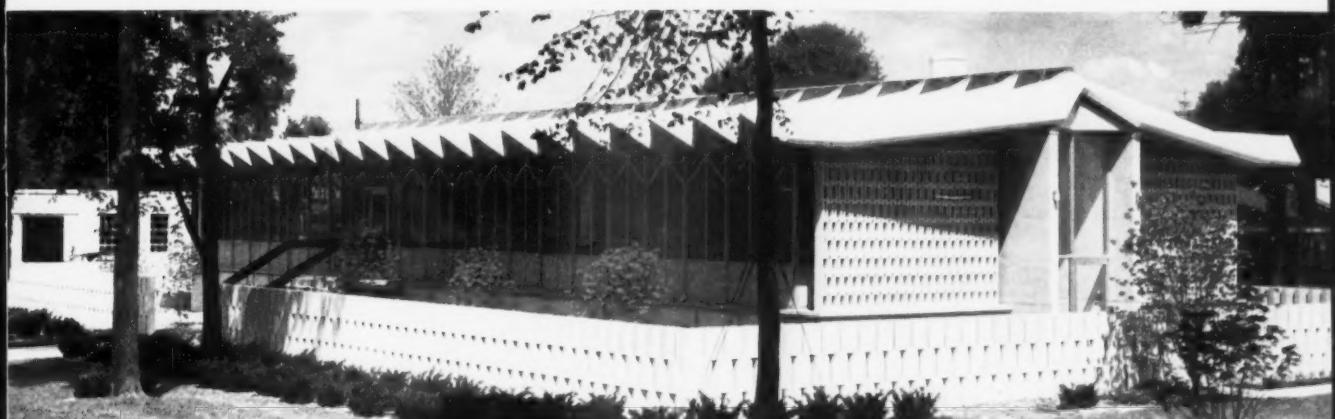
The Master Builders Company, Cleveland 3, Ohio

Division of American-Marietta Company

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*POZZOLITH is a registered trademark of The Master Builders Co. for its concrete admixture to reduce water and control entrainment of air and rate of hardening.



From the Editor's Tranquil Tower

THE CONSULTING ENGINEERS in Canada are a most fortunate professional group. Their government is on their side.

A few weeks ago, the Hon. Gordon Churchill, Minister of Trade and Commerce, addressed the Professional Engineers Association of Ontario; his subject, "The Engineers and Canada's Trade." It is only to be expected that a government official, speaking before any special group, would make every effort to please and compliment his audience, but Mr. Churchill went further than that. He gave examples illustrating the efforts the Canadian government is making in the interest of engineers in private practice.

The Minister of Trade said that his department has been active in endeavors to assist in the search for foreign business for consulting engineers. "Our trade commissioners abroad, as well as officers in the Department, are anxious to help Canadian engineering firms to secure a larger share of engineering opportunities to be found in the foreign field. They are active in advancing Canada's reputation in foreign countries by giving publicity to Canadian engineering achievements."

Contrast this with the attitude of our Department of Commerce, our State Department, or the I.C.A. Because of our position as a great world power, our government has much more to gain politically and economically than has Canada, yet where is there a man in the Departments of Commerce, State, or the I.C.A., high or low, who has given much thought to the huge role that U.S. consulting engineers could play in world affairs?

Getting back to Mr. Churchill, he went on to say, "Nowadays, the Department finds itself working closely with consulting engineering firms. A number have obtained assignments for the design and supervision of construction of pulp and paper plants in Norway, Sweden, Finland, Spain, Portugal, Brazil, Mexico, Pakistan, and Egypt. In such assign-

ments abroad, the professional engineer acts as an ambassador for Canadian industry. While maintaining the highest professional standards, he prepares the way for increasing Canada's share of equipment orders. Accordingly, the Department pays particular attention to keeping firms in touch with opportunities abroad."

Compare this with the situation in this country, where an engineering firm interested in a foreign project would have to establish all sorts of contacts in Washington through lobbyists, friends of friends, and sometimes worse. This does not mean that our government is necessarily corrupt in dealing with consulting engineers, but it takes some real influence to even interest a government agency in a consulting engineer firm and its capabilities.

Churchill continues, "Requests for consulting engineer services . . . are carefully analyzed and brought to the attention of interested firms."

How many U.S. firms have had jobs called to their attention by State or Commerce?

"The [Canadian] Exports Credits Insurance Corporation makes insurance of foreign payments available to consulting engineering firms . . ."

Our consultants are not even offered encouragement, much less insurance by the U.S. government.

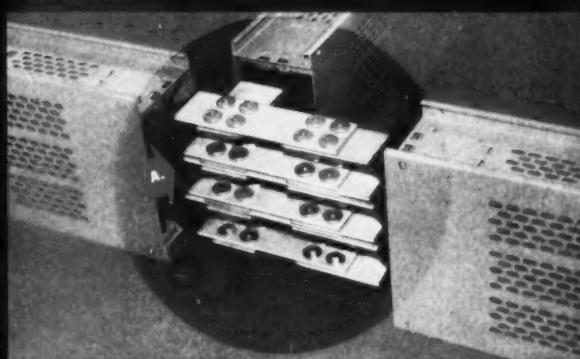
"The Department is in close touch with [The World Bank] through its post in Washington and through the Trade Commissioners in countries where loans are being made. They are prepared to introduce Canadian engineers to the proper officials, for the Bank requires that prospective borrowers engage the services of competent consulting engineers to advise on the economic and engineering feasibility of projects for which financial assistance is being sought."

Contrast this with our situation. A number of World Bank projects are, it is true, under the direction of U.S. consulting engineers, but no thanks to an introduction from our Department of Commerce or any of our trade commissioners abroad.

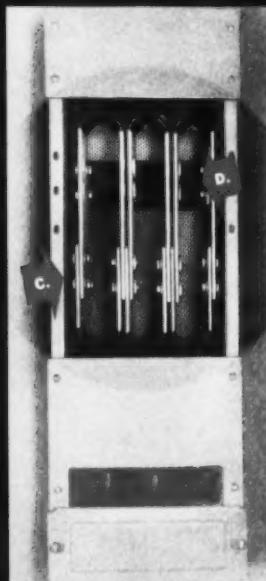
The contrast is startling, yet Canada is rather representative of the attitude of most governments toward their consulting engineers. Our own government is unique in having little interest in encouraging the use of consulting engineers on foreign projects. ▲▲

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BRIDGE RAILINGS AREA EXPRESSWAY



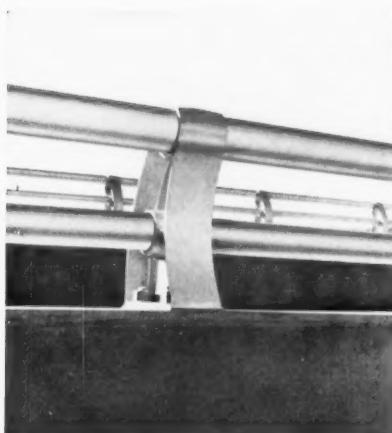
Flynn CP-12 standard cast posts were used on the two-rail bridge jobs shown here and below.

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This three-rail installation has Flynn CP-13 standard cast posts.



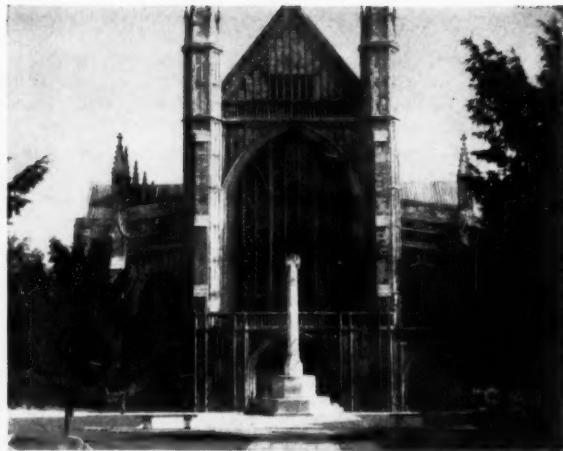
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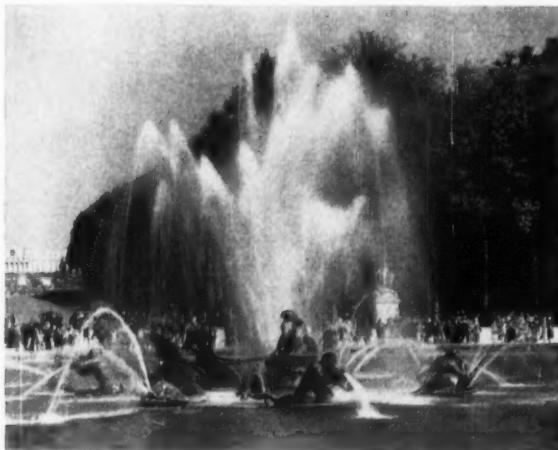
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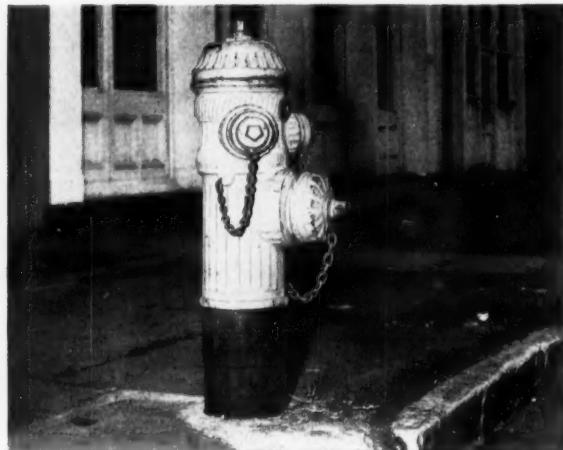
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Cathedral, 1065



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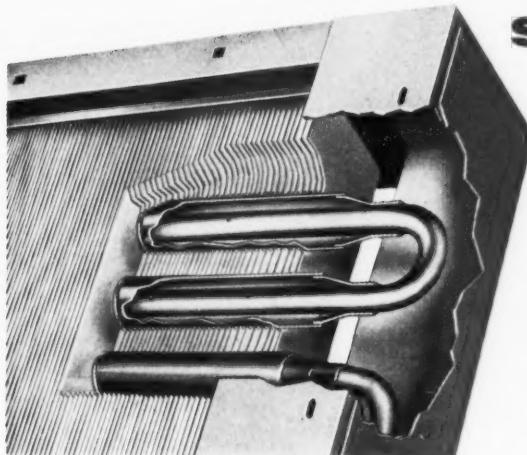
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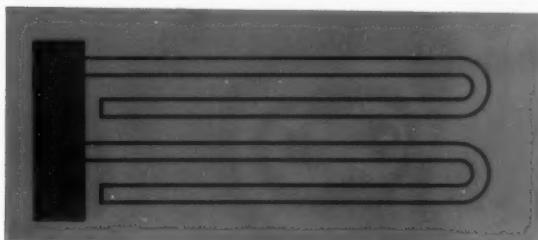


↑ Nesbitt Series T Heating Surface employs a unique principle by which you can achieve uniformity of steam distribution unmatched by conventional arrangements. It is ideally suited to applications requiring direct pre-heating of outdoor air, or where uniform discharge temperature under throttled control is important.

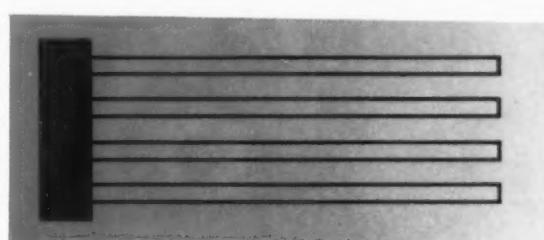
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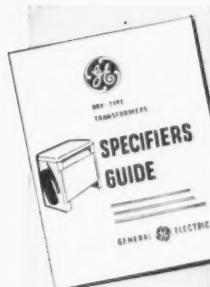
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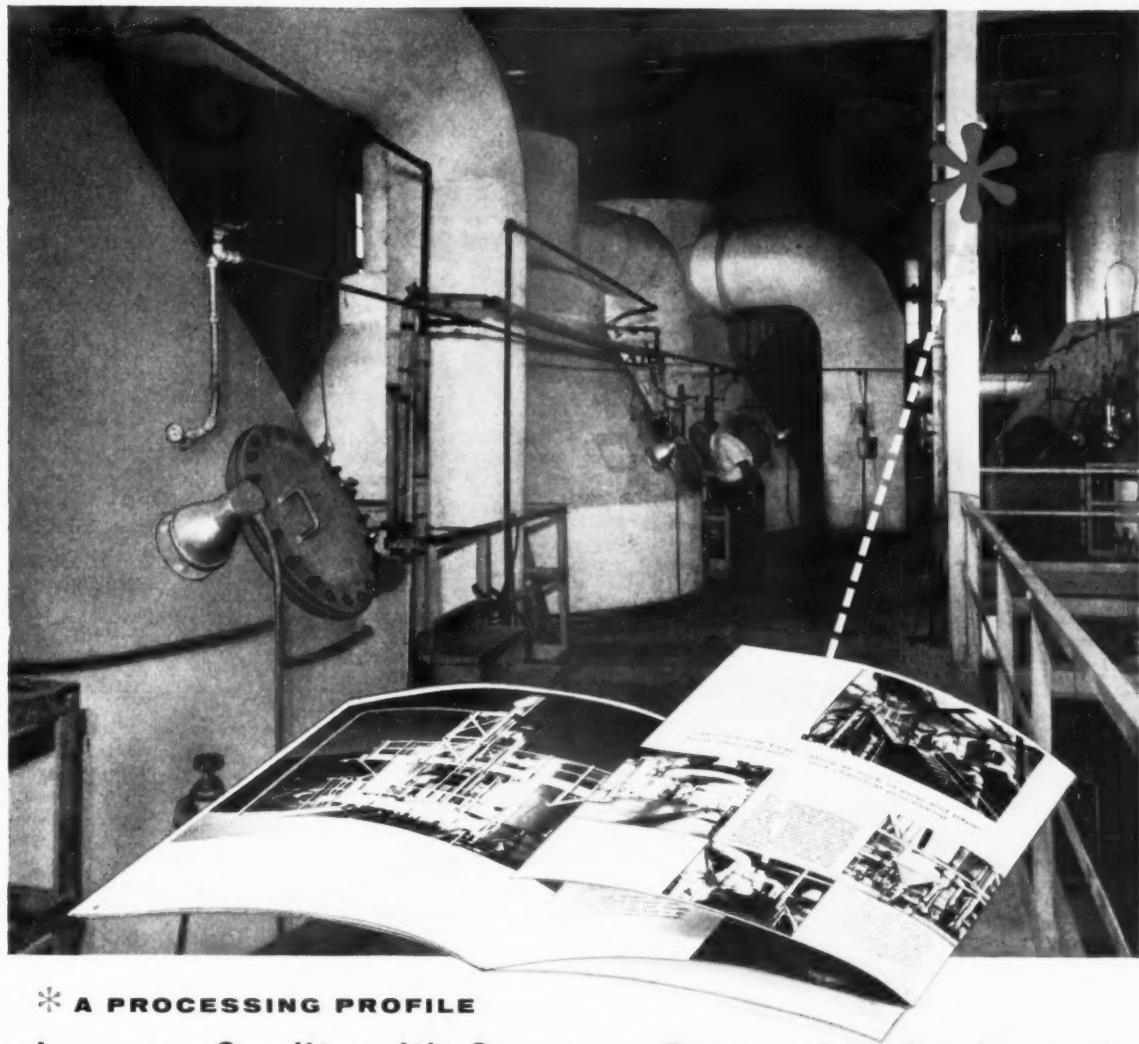
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mortgagee takes legal action to foreclose it. Normally, this must be done in the equity court, and it will automatically entail a delay of a year or so because of the generally crowded condition of the court's docket.

Foreclosure of Mortgages

It is necessary for an unpaid mortgagee to foreclose the mortgage not only to realize on his security, but also to cut off the mortgagor's interest in the property. The usual type of foreclosure is handled by the equity court, with a decree for a public auction sale. The mortgagee obtains the amount of the debt out of the sale price, and the excess goes to the mortgagor. If, as normally happens, the auction sale is poorly attended and a very low price is obtained, there even may be a deficiency still owing the mortgagee. The court then will give him a decree against the mortgagor for this deficiency, which can be realized by execution against other assets he may have.

This same situation applies even though it is the mortgagee himself who buys at the auction. In such an eventuality, the mortgagee will end up owning the property and, in addition, the mortgagor will still owe him a substantial portion of the debt! The court has power to invalidate the auction sale if it is very unfair to the mortgagor, but this does not happen often. Thus, the mortgagor owes it to himself to have at least one rich friend standing by at the auction to make sure that the bidding is realistic.

Strict Foreclosure

A second type of foreclosure is the strict foreclosure—that is, foreclosure without sale. Here, the mortgagee gets title to the property, there is no auction sale, and no excess or deficiency. The mortgagee not only gets the title to the property, but also keeps any payments previously made. If a large percentage of the payments have been made, this would be grossly un-

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Note: New 4-D Wrought Iron was achieved by substantially increasing the deoxidation of the base metal, slightly increasing the phosphorous content and using a more siliceous iron silicate.

Result is increased corrosion-resistance, improved mechanical and physical properties.

INSTALLATION	COST PER FOOT PER YEAR	
	WROUGHT IRON	STEEL
Hotel, Brooklyn, New York Hot ammonia gas passing through interior of tubes, cooled by salt water circulating along outside of tubes.	\$.03 (19 years)	\$.24 (2 years)
Ice Company, Chicago, Illinois Carbon dioxide condenser service.	.03 (18 years)	.05 (10 years)
Film Corporation, Binghamton, New York Tubes used in cooling service.	.04 (15 years)	.06 (8 years)
Industrial Plant, New Bedford, Massachusetts Ammonia condenser with salt water in coolant.	.04 (12-14 years)	.48 (1 year)
Industrial Plant, Toronto, Canada Tube and shell type condenser used for cooling brine with ammonia.	.01 (50 years)	.07 (7 years)
Ice Company, Aiken, South Carolina Ammonia condensers with mild brine solution containing 76 ppm sodium chloride for cooling.	.03 (18 years)	.29 (2 years)
Ice Company, Rocky Mount, North Carolina Condensers with mild brine solution containing 75 ppm sodium chloride for cooling.	.07 (8 years)	.16 (3 years)
Industrial Plant, Wisconsin Vaporizers for production of butane and propane gas. Severe stresses created by wide temperature variances.	.28 (2 years)	.96 (6 months)
Oil Company, Long Island City, New York Cool, weak ammonia liquor cools hot, concentrated ammonia liquor coming from generator on the way to absorber.	.03 (20 years)	.07 (6-8 years)
Process Company, Detroit, Michigan Heat exchangers with ammoniated brine concentration of about 10% ammonia and salt almost to saturation point.	.08 (8 years)	.16 (3 years)
Gas Company, Brooklyn, New York Ammonia condenser with cooling medium of creek water contaminated by the refuse from several nearby industrial plants.	.05 (16 years)	.22 (3-5 years)
Alkali Company, Saltville, Virginia Heat exchanger carrying ammonia liquor that is subsequently cooled by surrounding water.	.05 (16 years)	.30 (6 mos.-3 years)
Industrial Plant, Chicago, Illinois Condenser tubes in absorption system. Ammonia inside the tubing is about 200 F. and water outside the tubes is about 40 F.	.09 (9-11 years)	.28 (3 years)
Electric Utility Company, Hunts Point, New York Gas cooler drawing water from East River in New York City.	.15 (8-9 years)	.45 (2-3 years)
Warehouse & Cold Storage Corp., Springfield, Massachusetts Ammonia condensers and direct expansion cooling coil.	.02 (30 years)	.04 (12 years)

"Cost per foot per year" figures are calculated from current prices of cold drawn seamless steel tubing (ASTM A-179) and cold drawn wrought iron tubing (ASTM A-382). Because of the many variables involved, costs for installation labor, maintenance and replacement are not included. If they were, wrought iron's low cost story would, of course, be even more impressive.

Details on any of the above installations furnished on request. Write for Wrought Iron Heat Exchanger and Condenser Tubing bulletin.



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fair to the mortgagor, and courts consequently do not permit strict foreclosures except where the amount of payments made is relatively small.

Often there is also a statutory short-cut type of strict foreclosure in many jurisdictions, which speeds up the process in cases where no equitable defenses are being raised by the mortgagor.

Additional Redemption Period

In addition, statutes today generally provide for an additional statutory redemption period after foreclosure. This makes it possible for the mortgagor to redeem his property by paying the debt to the public sale purchaser, within a period of a year or so after the sale. The object of these statutes is to protect the mortgagor from sales at very low prices. These laws generally are regarded, however, as having had the opposite effect — they discourage purchasers at foreclosure sales from investing their

money, and hence actually lead to lower prices. And since the mortgagor generally is not able to redeem anyhow, he is worse off than without the statute.

Acceleration Clauses

While a failure to make one payment on time will not work a forfeiture of the mortgagor's interest (despite what the mortgage instrument says about it), there is usually an acceleration clause in the instrument, which makes the entire debt payable immediately after a default, instead of over the original extended period. Such clauses are given effect, with the result that if the mortgagor wishes to redeem, he must pay the entire debt, rather than merely the overdue payments.

"Assuming" the Mortgage

When mortgaged property is sold by the owner-mortgagor to a third party (or assignee), the assignee may or may not make a promise (generally in the deed he receives)

to make the remaining mortgage payments as they come due.

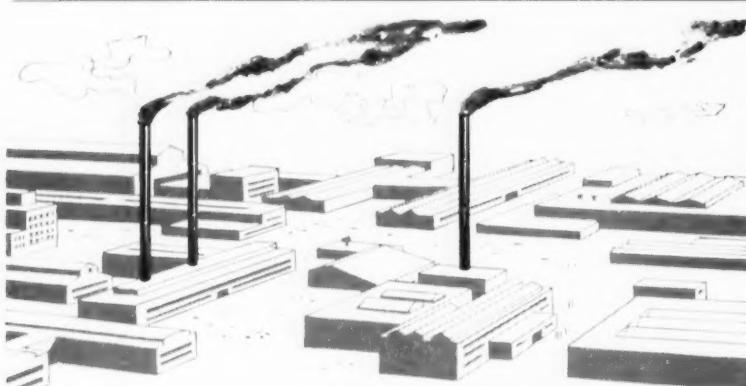
If the assignee makes such a promise, he is said to have assumed the mortgage, and will be personally liable on the debt. Not only is he personally liable to the mortgagor if the latter is eventually forced to pay the debt, but he is alternatively liable to the mortgagee, on a third party creditor beneficiary basis. In addition, of course, the property he has bought is liable to be foreclosed if the debt is not paid.

Where the assignee assumes the mortgage, he becomes primarily liable on the mortgage debt. The original mortgagor is not released from his original promise to pay the mortgage debt but is now relegated by operation of law to the position of a surety on the debt. Thus, if the original mortgagor is forced to pay, he can recover from the assignee; in fact, when he pays the mortgagee, the mortgagor steps into the shoes of the mortgagee and takes all his rights against the assignee, not only as to the debt, but also as to the security. In other words, if necessary, he will be able to foreclose against the assignee.

"Subject to" the Mortgage

On the other hand, where the assignee merely takes subject to the mortgage, and the understanding is that the original mortgagor will complete the mortgage payments, the only personal liability on the debt is that of the original mortgagor. If he pays, he obviously cannot recover from the assignee. But if he fails to pay, and the assignee pays the debt to avoid foreclosure of his property, the assignee has a right to recover from the original mortgagor. However, the assignee has no security to protect him, as he obviously cannot foreclose on his own property.

There are many further permutations and combinations possible, which tend to make the subject lots of fun for lawyers and lots of headaches for the uninitiated. ▲▲



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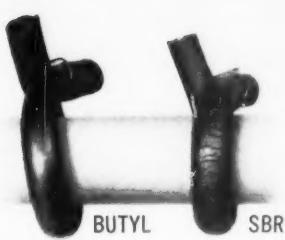
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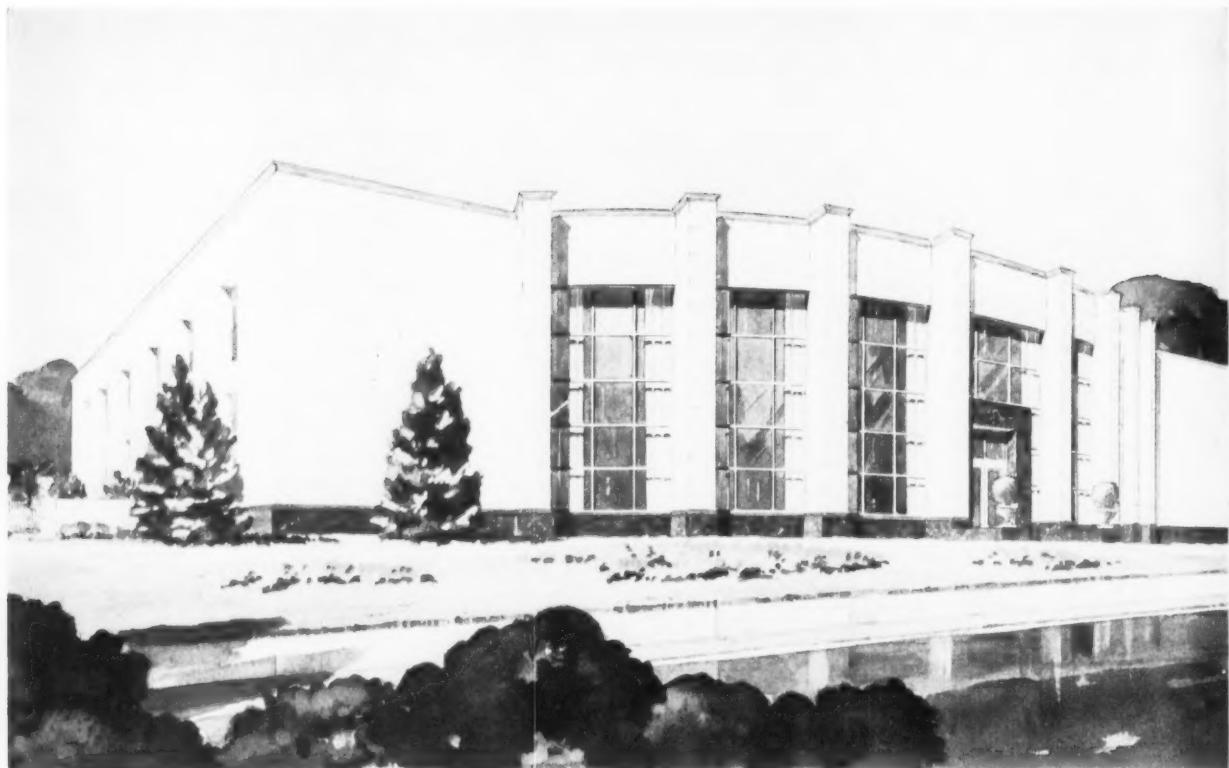
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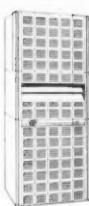
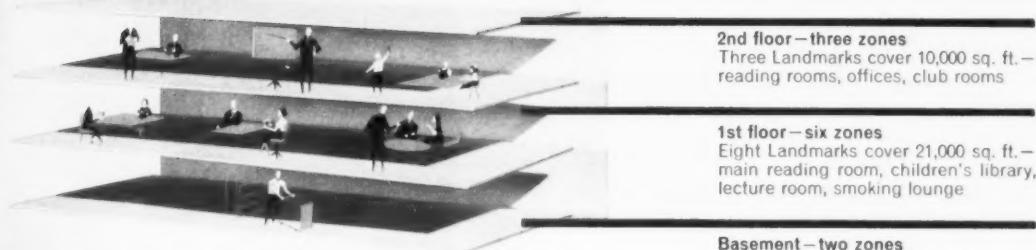
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For complete facts on the new Landmark—and how its flexibility may solve many of your heating-cooling problems—call your local Lennox Comfort Craftsman. Or write Lennox Industries Inc., Marshalltown, Iowa.

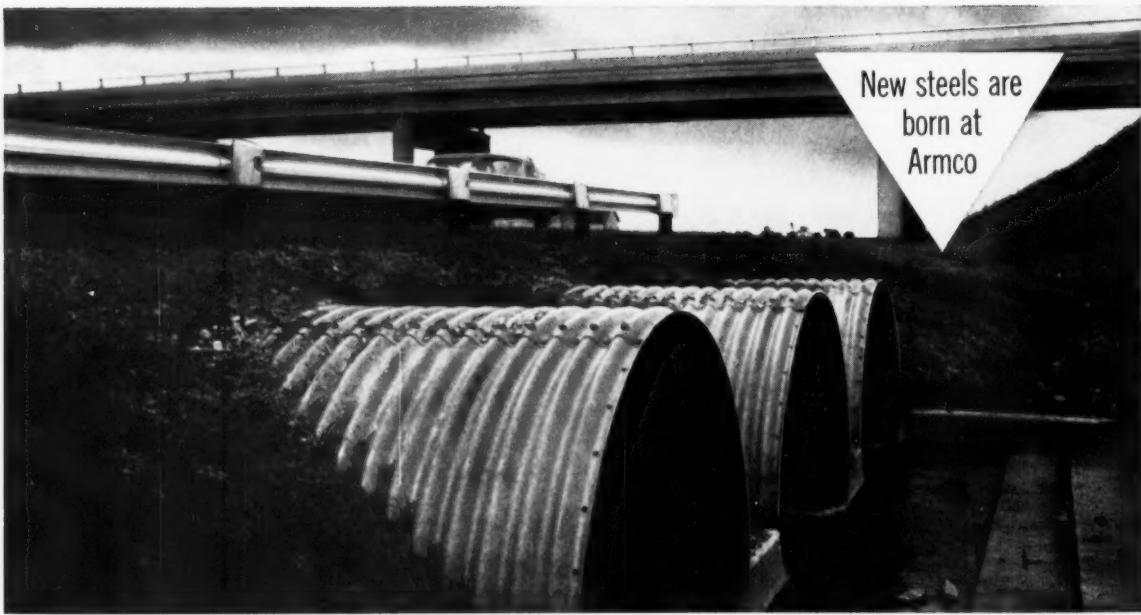
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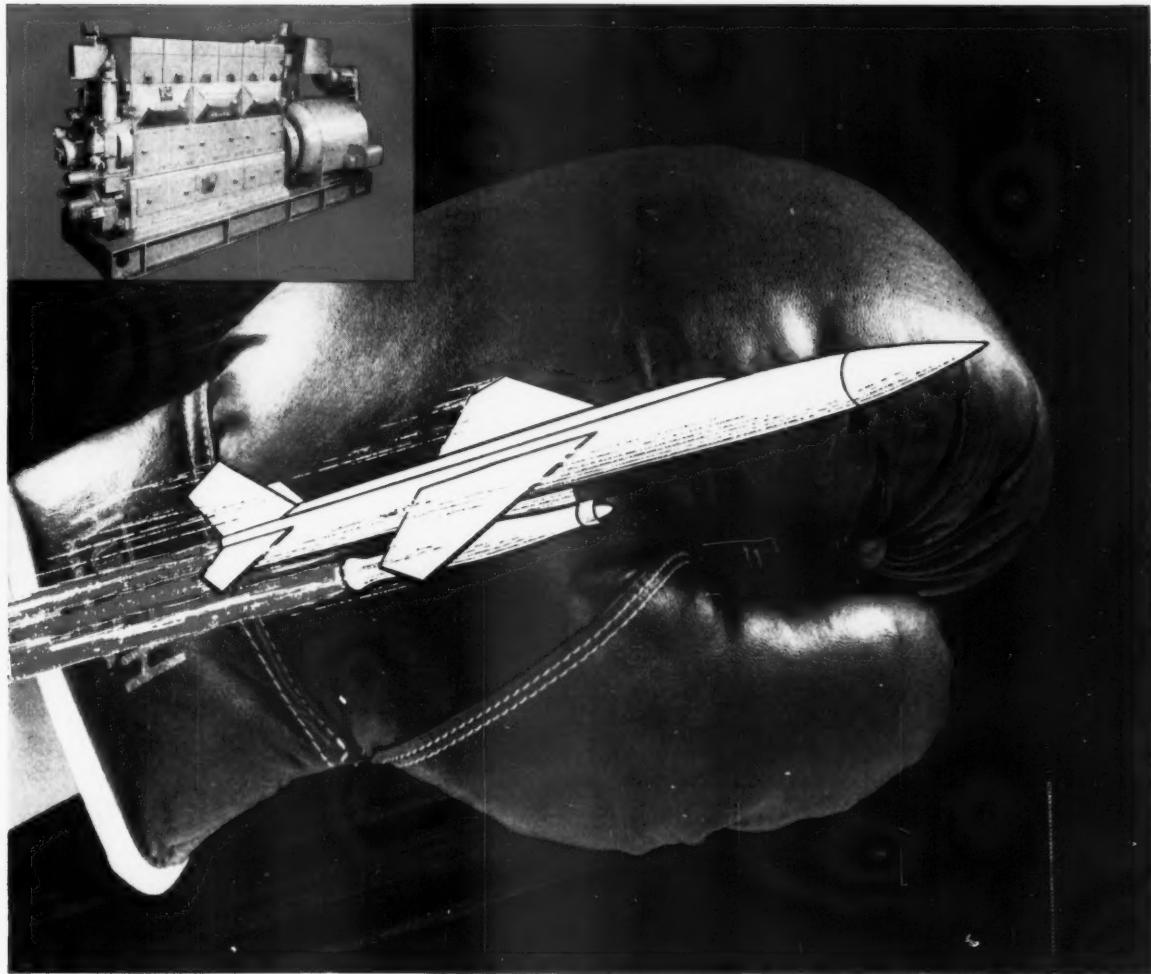
Taken in 1923, this photo shows twin Armco Pipes installed in original highway in 1907.

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Report from the West Coast

RALPH S. TORGERSON

West Coast Editorial Representative

Two ASSOCIATIONS on the West Coast are giving serious attention to the problem of informing engineering school students about the consulting engineering profession, with emphasis on the ethics which govern the actions of its practitioners and the economics involved in conducting a successful operation.

Directors of the Consulting Engineers Association of Oregon are exploring the possibilities of introducing courses of study or seminars in engineering schools. At the recent annual meeting of the Consulting Engineers Association of California, a panel discussion on the study of professionalism in en-

gineering schools stirred up some lively discussion. Many members have volunteered to appear before engineering students as lecturers on private practice.

Consultants Indicate Interest

A survey conducted among consulting engineers indicates widespread interest in the subject and a belief that action toward the introduction of professional engineering courses or seminars is long overdue. Most engineering school graduates have only a meager understanding of private practice. This lack of understanding has contributed to the reluctance of engineering school graduates to accept employment with consulting engineers. It also has been a factor in slowing the training of the few that do, since these young engineers do not understand the ethics or economics of a soundly conducted firm.

Movies May Be Useful

One comment indicated that it might be desirable to start with the high schools, where prospective engineers could be given their first insight into the part the consulting engineer plays in our economy.

Allen E. Hill, of Hill and Ingman, Seattle, reported that the high school his children attended has presented speakers represent-

NIAGARA "no frost"



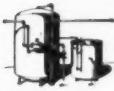
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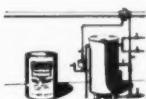
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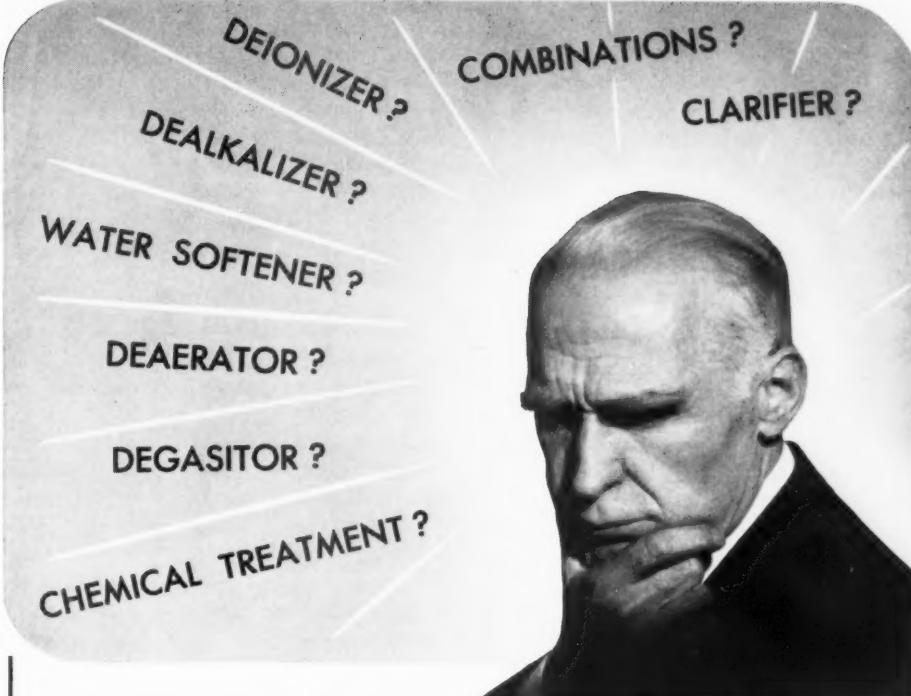
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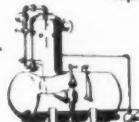
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ing various fields of work to acquaint students with industry and the professions with which they might become allied. Consulting engineers have spoken before these groups. "Our firm," he said, "would certainly be interested in furthering such an idea and would be in position to provide speakers at any meetings that might be arranged in our area." His firm recently was featured in a half-hour movie, sponsored by the Richfield Oil Co., which pictorially outlined the functions of the engineering firm and showed how ideas are developed from the beginning to the completion of the client's project. He suggested that films of this type could be very helpful in showing student groups the functions of the consulting engineer and operations in an engineering firm's office.

Richard J. Woodward, of Woodward, Clyde, Sherard and Associates, Oakland, decried the trend of engineering schools toward the hiring of teachers with little engineering background.

The emphasis, he pointed out, seems to be more and more on advanced degrees as a prerequisite for teaching ability in the engineering schools.

"I think it would be very advisable," said Woodward, "to have courses of study or seminars introduced to deal with the consulting engineer profession. I am of the opinion that it would be desirable to have an address to the senior engineers given once a semester by a consulting engineer in the area. This would be a minimum and is certainly less desirable than a course which would devote several periods to the problems, the advantages, and the disadvantages of the consulting engineering profession. I think most of the graduating engineers have no idea of what the profession is."

Favors Seminar Approach

H. Loren Thompson, of Stevens and Thompson, Portland, a former engineering school professor, sug-

gests that the best approach would be through seminars rather than incorporation of a course on consulting engineering in the curriculum. He feels that present curriculums are so complex that the introduction of a specific course geared to consulting engineering practice might require the dropping of more important work. "Seminars have been held at Oregon State College for a number of years," said Thompson. "These seminars are conducted by the heads of the engineering departments, and in civil engineering have occurred once weekly during at least one of the semesters of the senior year." Referring to the teaching of ethics, Thompson expressed the view that "if engineering teachers cannot get a certain amount of ethics across to students, then the professor is not meeting his true responsibility."

Dudley Deane, of Dudley Deane and Associates, San Francisco, believes engineering graduates generally are not prepared for consulting work. "While they may have the basic engineering background, they usually lack sufficient knowledge of economics, accounting, general business administration, public relations, and usually even proper groundwork in speaking and writing the English language. I do not know of any courses in consulting engineering being offered in engineering schools on the West Coast, but I feel that they would be of great benefit to our profession and to engineering students in general. With the cooperation of consulting engineers and teachers, seminars might be an effective method for starting a program."

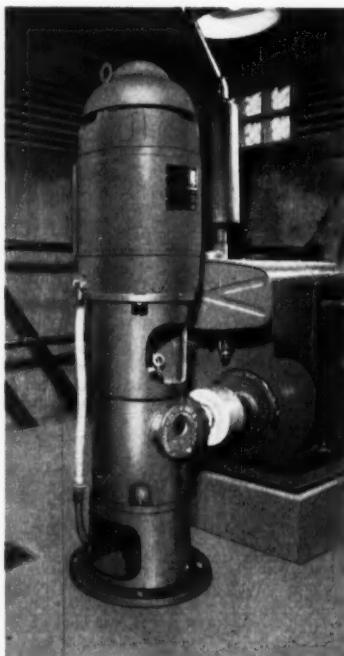
Paul H. Isaac, of Hammond, Collier and Isaac, Seattle, doubted that educators would agree to courses on consulting as required subjects. He suggested that "at present the most feasible method of putting this information before the students would seem to be through the student chapters of

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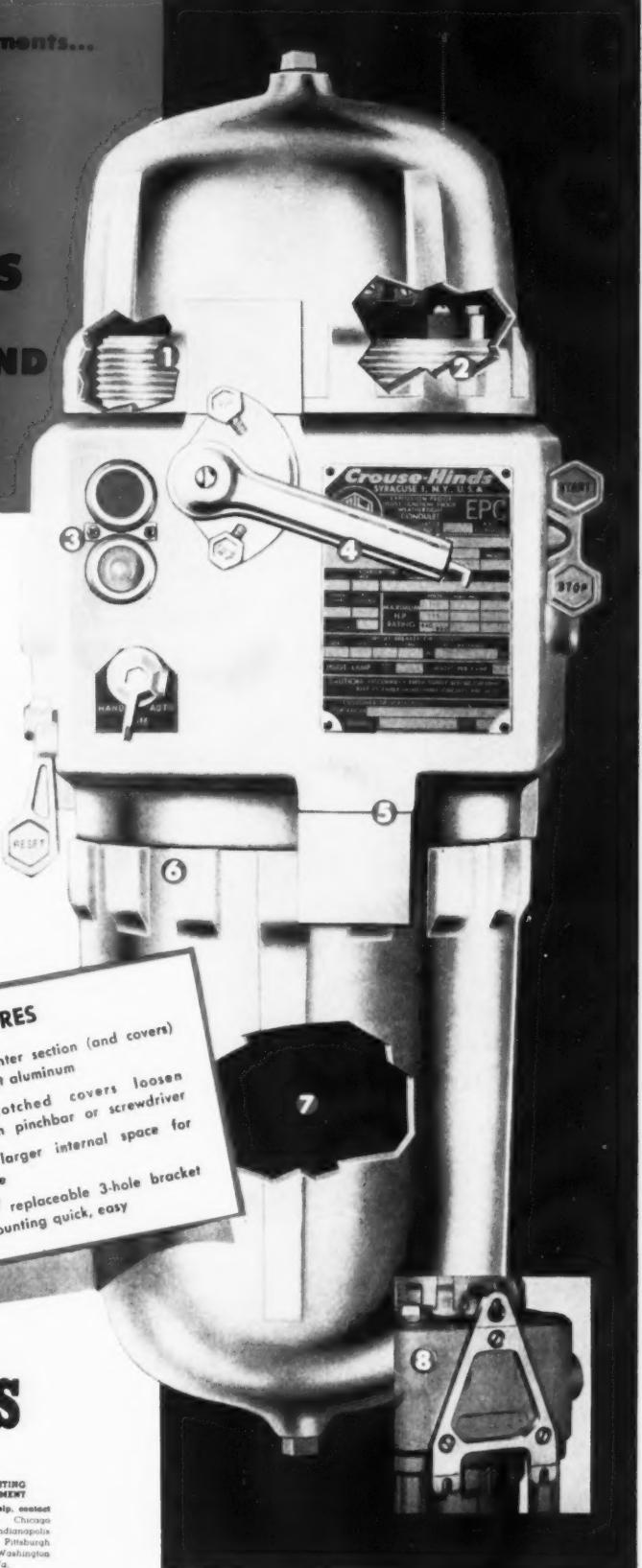
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the various Founder Societies. This will not reach all of the students, however, since only a part of them join the student chapters. Certainly, in the beginning, the instruction would have to be as a seminar with lectures provided by consulting engineers. I believe that NSPE would be a better organization to sponsor these courses inasmuch as they represent engineers in all fields of practice, both public and private. I understand NSPE currently is publishing a book on professionalism intended for use as a text in courses such as those proposed by CEAQ. Under their sponsorship it might be possible to have professionalism included as a required course."

Brochures a Possibility

Harold P. King, of King, Benioff and Associates, Sherman Oaks, California, and 1958 president of CEAC, feels that the teaching of professionalism in our universities has been neglected and that it is

the responsibility of the practicing consulting engineer to help our colleges give courses. "Perhaps a good start for a program," he said, "would be to send members of the engineering graduating classes a brief explanation of what the consulting engineer stands for, and what the possibilities of going into private practice are. A code of ethics, either the state association's or Consulting Engineer Council's, also could be included. This at least would be a start and would bring to the attention of graduates the possibilities of entering private practice and also, if they go into public service, they would appreciate the position of consultants."

Student Talks

H. J. Brunnier, San Francisco, recalled that as far back as 1911 he had periodically talked to student engineers at the University of California and occasionally at Stanford University. "Only on a few occasions," he pointed out, "have these

talks been technical; they were generally of the inspirational type, endeavoring to implant into the students' thinking the necessity for being ethical and rendering a service that will make them proud of their profession." He recently accepted an invitation to talk to the ASCE student chapter at the Los Angeles meeting, on the subject "Joys of Engineering." Brunnier believes that courses in engineering schools are already quite crowded and that one or two talks a year with a question and answer period would serve the purpose of acquainting engineering students with the consulting engineer.

Requirements Are Broad

Murray Erick, of Murray Erick Associates, Los Angeles, pointed out that those who have spent many years in private practice have learned the hard way that detailed design and drafting is the simplest part of the profession. "We have seen many young men of above average abilities, but with limited experience, enter private practice soon after obtaining their licenses. Not many of these young engineers have even a speaking knowledge or understanding of such fundamental functions of a consulting engineer as:

- ¶ Management and cost of doing business
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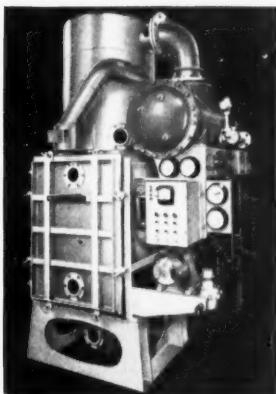
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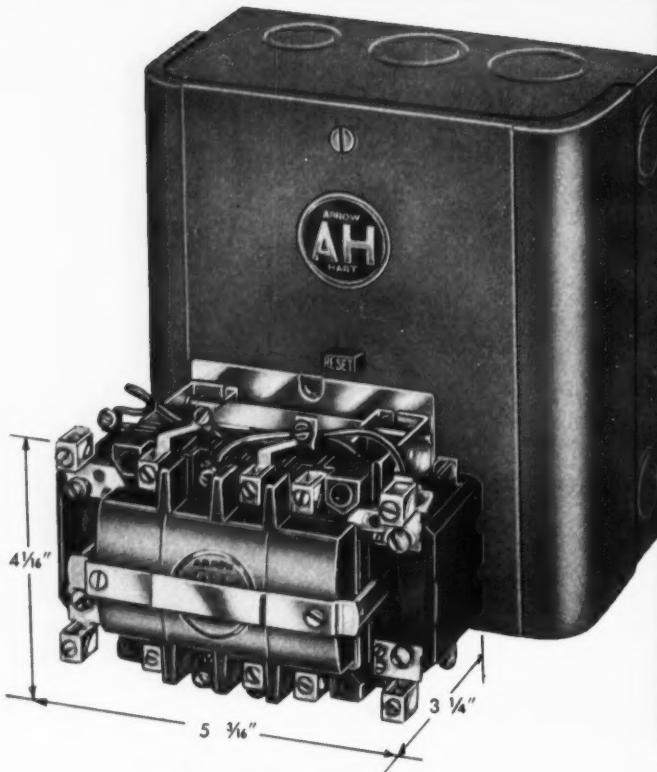
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have been considerably reduced; this is in spite of the fact that fees, percentagewise, and construction costs have increased.

"The lack of understanding of proper consulting engineering and the unethical practices resulting therefrom are continuing factors in lowering the standards of the profession. The longer these conditions and practices continue, the harder it will be for the professional engineer to improve his standing in the public eye and to attract graduating engineers to the field of private practice.

"I most heartily subscribe to the idea of a course of study dealing with consulting practice if it can be crowded into the already loaded curriculum of the engineering college. However, I anticipate considerable resistance from the faculty in most instances. The seminar could, in my opinion, do an excellent job if properly set up on a basis of one session per week over the entire senior year and might well be a means of attracting more graduates to our field. I believe that consulting engineers and our associations will heartily subscribe to either a course of study or a seminar and that speakers would be available on a rotating basis."

UCLA Teaches Professionalism

S. B. Barnes, of S. B. Barnes and Associates, Los Angeles, made some inquiries into the teaching of professionalism in engineering schools and found that UCLA was apparently the only southern California engineering school that made a definite attempt to teach students something about practice and ethics involved in consulting engineering. Other schools have no instructions along these lines, but occasionally they do have speakers or instructors who may discuss private practice as a part of their courses. However, this depends entirely on the instructor himself. Barnes found that contrary to the customary belief, graduates of at least one school, California Institute of Tech-

nology, give number-one priority to private practice in looking for jobs immediately after graduation.

Frank E. Alderman, of Alderman and Swift, South Pasadena, California, is heartily in favor of introducing into engineering schools the subject of ethics and good practice in the consulting field. "While I doubt if many colleges can be induced to devote entire courses to this subject," said Alderman, "I think that a great deal would be gained by holding seminars or special lectures for graduating engineers. The subjects probably could be covered best by consulting engineers, who are meeting the problems daily, rather than by regular professors on the college staff. I am sure that there would be no difficulty in obtaining the gratuitous services of consulting engineers for that purpose, provided the length of time required did not become unduly burdensome."

Students Skeptical

W. Bruce Morrison, of Portland, pointed out that Oregon State College devotes one lecture period to the subject of private professional engineering practice. However, as a general rule, three weeks later the students cannot even remember the discussion. "In our contact with the students," said Morrison, "some of them feel that job security is so important that they would rather get buried in a niche in a state or Federal government job or with one of the large corporations than take the gamble of private practice. This is unfortunate as there seems to be an ever-increasing need for consulting engineers."

Carl E. Green, of Carl E. Green and Associates, Portland, also suggests that an effort be made to have each engineering school devote at least one regular meeting of each student chapter of the various engineering societies to the subject of ethics and the practice of engineering by consulting firms. He felt the engineering associations should provide the speakers

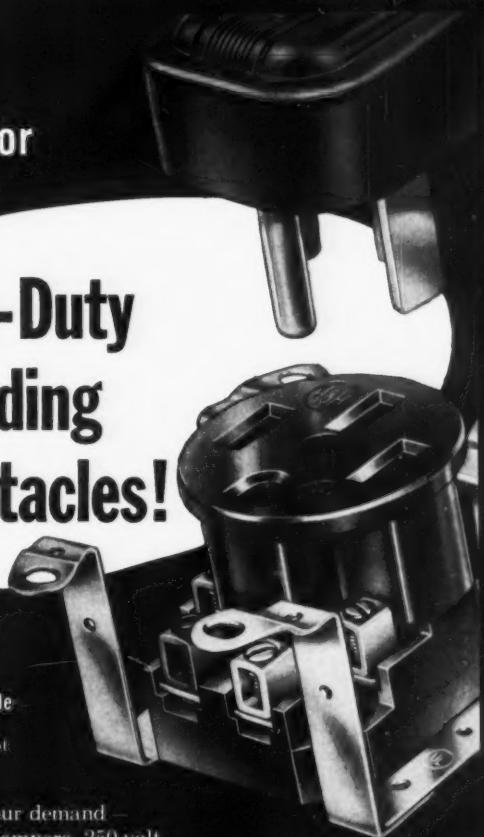
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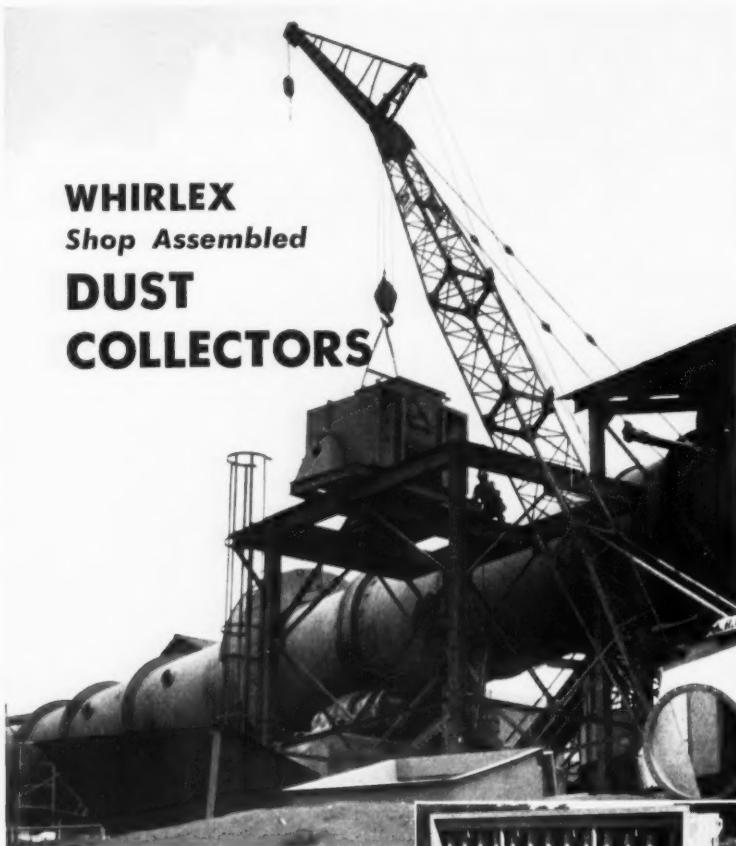
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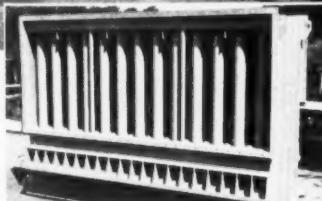


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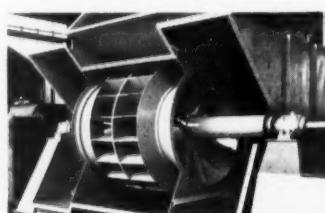
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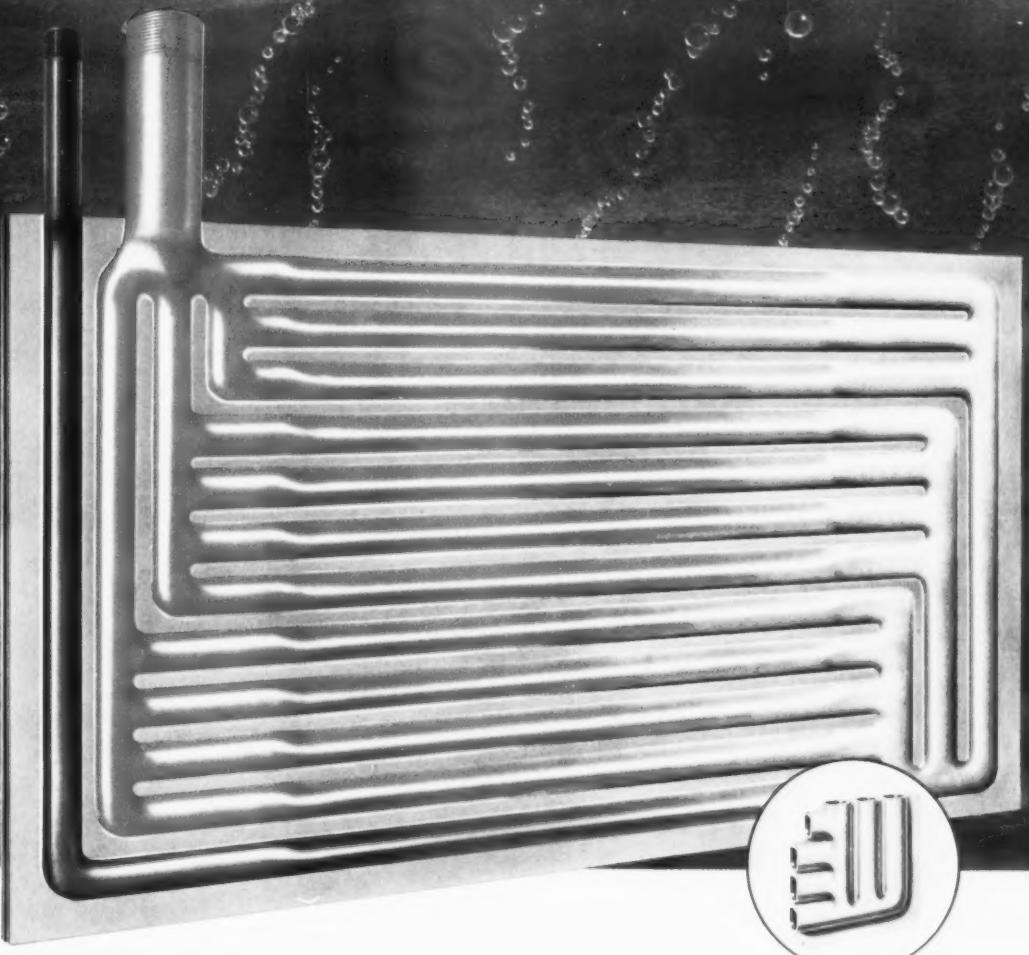


for the meetings. "Perhaps it would be just as important," said Green, "to cover the ethics, economics, and business phases of engineering with faculty members as well as students because many of the members of the various faculties may not have had experience in private practice. If these matters were to be covered, it might best be given in a seminar for senior or graduate students. Assistance by engineers in private practice might be necessary to make a good course possible."

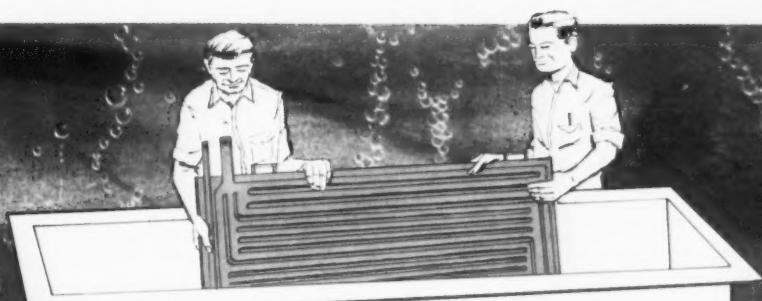
Note of Caution

Norman R. Carson, of R. W. Beck and Associates, Seattle, reports that the engineering schools there do not have a course to acquaint students with private practice and do not contemplate the introduction of such a course as it would benefit only a minority group. Carson explored with the colleges the idea of some of the professional societies offering two or three evening sessions for the graduating engineers shortly before graduation. The colleges felt that the attendance on a voluntary basis would be poor and would depend upon the prior stimulation of interest in the consulting field.

This problem, Carson believes, would seem to be best solved by the professional societies making available to the engineering student, through channels other than college curricula, the advantages and desirability of a career in consulting engineering as well as where and how to prepare himself for such a career. However, Carson cautions, "We believe that the engineer, as now schooled, is no more attractive to the consulting engineer than the consulting engineer is attractive to him. The students are not familiar with office practices and ethics, and as a result, the consulting engineer cannot offer him initial employment as lucrative as he can get elsewhere in manufacturing, research, utilities, and industry in general." ▲▲



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The new MULTI-ZONE PLATECOIL offers the time-proven advantages of PLATECOIL over pipe coils. Higher efficiency saves tank space. Standardized "package" units can be engineered quickly and accurately with readily available performance data. You completely eliminate the cost of cutting and assembling pipe coils. Installation costs are low because PLATECOIL units are lightweight and easy to handle. Pre-engineered, ready-made hangers are designed for fast installation and re-

moval of plates for cleaning. Cleaning is easy due to the streamlined PLATECOIL design, which also tends to retard the build-up of deposits on coil surfaces. Electric-welded and pressure tested, PLATECOIL units have no threaded joints to corrode or leak. Simple connections can be located above the liquid level, free from contamination.

Put this new PLATECOIL to work for you to cut costs on all types of heating and cooling applications.

Send for NEW PLATECOIL Bulletin No. P85 for complete specifications and performance data.



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PLATECOIL®
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ASSURES YOU BETTER BALLAST VALUE

*ETL checks 12 to 14 specified ballast characteristics
on all Certified types in production
by each manufacturer, verifies compliance
by test... and does it every month!*



THIS is important: Because if any ballast fails to measure up, the right to carry the emblem "Certified CBM by ETL" is withdrawn.

What characteristics are checked? The operating qualities which the American Standards Association has determined will give dependable, rated performance from the lamps with which the ballasts are designed to be used. These constitute the CBM Specification and assure:

- High power factor • High light output • Positive starting • Rated lamp life • Limit on heat rise
- Control for steady light • Quiet operation

From these qualities come practical benefits: Up to 2,500 hours more lamp life than with ordinary ballasts; as much as 40% more light output; and savings

on installation . . . with less wire, fewer circuits needed for fixtures CBM equipped . . . fewer fixtures for the same level of light.

For the latest facts on why it pays to specify fixtures equipped with Certified CBM Ballasts, ask us to send you CBM NEWS.



**CERTIFIED
BALLAST
MANUFACTURERS**

2116 KEITH BUILDING
CLEVELAND 15, OHIO

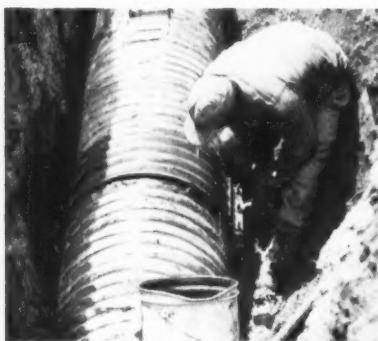
Participation in CBM is open to any manufacturer who wishes to qualify



Long sections can be handled with light equipment.



Connecting half-bands are imbedded in asphalt.



Connecting half-bands are bolted, for a tight, leak-proof joint that won't pull apart.

Republic **FREE FLOW** Sewer Pipe speeds up sewer construction

Thousands of new sewers are needed throughout the country as the result of the building boom. In fact, some communities have ruled that sewers must be installed before any more building permits will be issued. The pictures on this page illustrate how Republic FREE FLOW Sewer Pipe can speed up sewer construction.

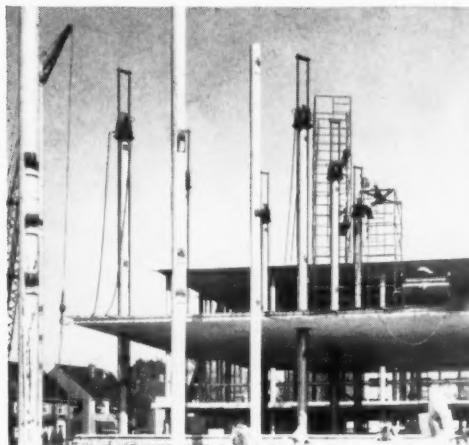
They show the 1410-ft. installation of 24"-diameter Republic FREE FLOW Pipe on Puritas Road, Cleveland, Ohio. This job was completed in *days* instead of months, because FREE FLOW is:

1. Lightweight . . . easy to transport, easy to handle.
2. Furnished in long sections . . . for easy installation.
3. Easy and quick to connect with leak-proof joints.

In addition a FREE FLOW installation gives you:

4. Flexible strength . . . ability to withstand flexure without damage . . . joints that won't pull apart.
5. No breakage during installation.
6. Non-spalling characteristics.
7. Superior erosion- and corrosion-resistance.
8. Free flow without turbulence.

Get a combination of all these superior features in Republic FREE FLOW, the corrugated, riveted, galvanized, coated metal pipe with the smooth, asphalt-lined interior surface. Mail the coupon for your copy of Republic FREE FLOW Sewer Pipe, ADV. 793.



TIME AND MONEY WERE SAVED when Republic Steel Pipe was used in erecting the Tremco Building, Cleveland, Ohio. Slabs were poured on ground, then gradually hoisted up 12-inch diameter pipe, by means of hydraulic screw jacks. Scaffolding, elevators, etc., were eliminated. Slabs were raised at a rate of 3' per hour.



FOR FAST, DEPENDABLE, FASTENING in highway and building construction, specify Republic Hook-Anchor-Foundation Bolts. Various types and sizes are available to meet specific job requirements, with dimensions ranging from $\frac{1}{2}$ " by 6" (overall length) to $\frac{1}{2}$ " by 20" (over-all length). They can be supplied with regular square nut and flat washer, not assembled — or can be furnished fully assembled, if you prefer.

THE EASE AND SPEED with which Republic Drainage Products can be installed can cut costs of drainage jobs. The complete manhole units shown were installed by the city of Ormond Beach, Florida, in less than a day. The result was a substantial saving over masonry construction. This quick assembly and installation, combined with extra long service life, make Republic Drainage Products your most economical buy.



QUICK, TROUBLE-FREE PERFORMANCE is yours when you use Republic Flexible Plastic Pipe to bring in construction water . . . or drain flooded excavations. Made of tough polyethylene, it resists abrasion and the effects of acids and alkalies. In addition, it is immune to electrolytic action. Light-weight and easy to cut or join, it can be used on job after job.



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Address _____

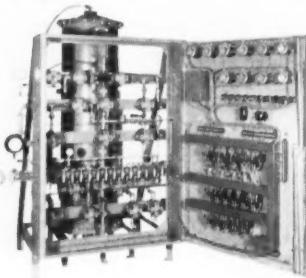
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**AUTOMATIC
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For all types of processes requiring very pure water. Completely automatic. All functions easily adjustable. Completely assembled, ready for hook-up. Made in a range of practical sizes. Write for particulars on these new, valuable, and highly adaptable units.



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ILLCO-WAY



Heard Around Headquarters

NEW MEMBERSHIP GRADES (see "Heard Around Headquarters," December 1958) have been approved by the American Society of Civil Engineers membership, but now there is another problem. Some of the other Founder Societies are not happy with the new classifications, particularly the new "fellow" classification. In most groups, "fellow" is used as an honorary title given an engineer after years of service to the profession or after some unusual engineering accomplishment.

Under the new ASCE classification, an ASCE "fellow" is substantially the same as the current "member." However, in addition to current requirements for membership, a future fellow also must be at least 40 years of age, have been in responsible charge for eight years, be registered, and must have previously been an ASCE member.

Spokesmen for the American Institute of Electrical Engineers and from the American Society of Mechanical Engineers indicated that the two groups do not like the idea of the ASCE failing to uphold uniform membership grades established in 1949 by the Engineers Council for Professional Development. Both ASME and AIEE pointed out that it is really none of their business, but they do think being a fellow in any Founder So-

cietiy should "have much greater importance than merely to indicate an engineer is licensed."

However, at this point the entire discussion is academic. The ASCE membership has approved all of the new grade classifications and under the constitution of the ASCE, that's that.

To Expel Member

The American Society of Mechanical Engineers, not among the groups with a reputation for a strict disciplinary hold over its membership, is considering the possibilities of expelling a member.

It has been a number of years since the ASME expelled any member, and the current case is in the speculation stage. The man involved was found guilty in a recent Federal Court case. However, under the ASME constitution he still is entitled to a complete hearing before expulsion.

Four to One

CONSULTING ENGINEER's poll shows that the consolidation plans for Engineers Joint Council and Engineers Council for Professional Development will be approved four to one by the Founder Societies. After a recent EJC Board meeting, details of the consolidation were sent to the Founders to get their opinions.

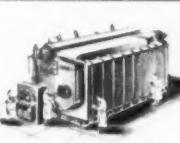
Rear mounted forced draft fan keeps firing front clear and provides proper flow of air to burner register preventing distortion of flame.



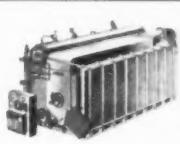
Designed to comply with or exceed Government Specification MIL-B-17095B. Either left or righthand units can be supplied.

Capacities to
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lbs. per hour

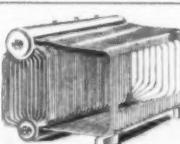
Completely plant assembled and factory fire tested with auxiliary equipment for capacity, efficiency and performance.



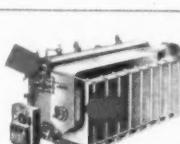
Rotary cup or steam assisted burners. Multiple burners where required. Burners for oil, gas, or both available on all units.



Tangent tube, waterwall furnace, all riser elements, discharge directly to steam drum. Drums extend both ends for maximum volume and releasing area.



Adequate inspection openings in casing. Refractory lined access door. Two manholes in each drum on sizes over 15,000 lbs. per hr.



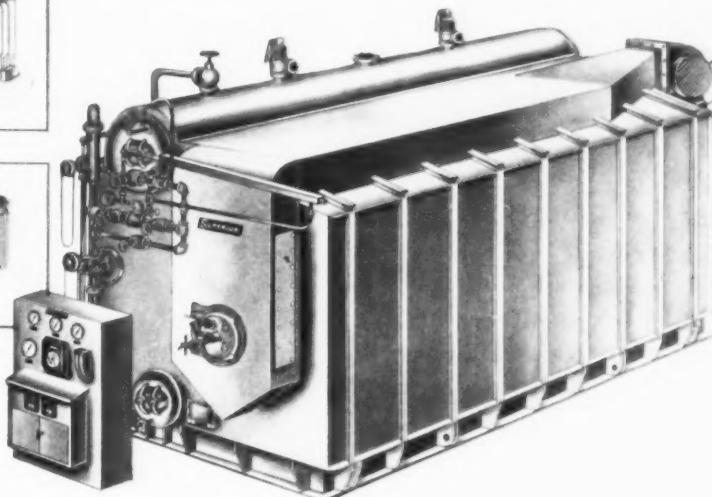
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Whether you are building, modernizing, or expanding, so many features contributing to low cost steam demand your consideration.

Completely integrated units combining the basic D type boiler tube arrangement with the most modern features of boiler design, Type D Superior Steam Generators are engineered for efficient firing with oil, gas or both. Performance rated for high availability and long life, with continuous steaming capacities to 61,000 lbs. per hour, plus overloads, they may be economically combined in batteries for much higher capacities. Each Type D Superior Steam Generator is completely assembled and fire tested at the factory. They may be transported by truck, rail or boat.

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LESSON II.

schoōl	chil'drēn	ae'ti vāted
chár'cōal	âir	o' dōr



THE STORY OF FRESH AIR

1. "Why," asked Miss Abigail, "is the air in our school so fresh and clean?"
2. Robert raised his hand. "Because it has been made free of odors with activated charcoal."
3. "Why don't we bring in large amounts of outside air?" asked the teacher.
4. "Oh, that would cost a pretty penny, in heating or cooling," suggested Hetty. "By recirculating inside air, we save lots of money for other things."

For everyone who doesn't have money to burn for heating all outdoors, we recommend advanced studies (Bulletin T332) on how activated charcoal cuts air conditioning costs, both initial and operating. Barnebey-Cheney Company, Columbus 19, Ohio.

Barnebey Cheney

*We gratefully acknowledge American Book Company's permission to use the illustration, and tip our hats to McGuffey whose First Reader is more than 100 years old.

on what the future strategy will be.

Only the American Institute of Electrical Engineers has voiced opposition. L. F. Hickernell, AIEE president, said his group thinks "it is in the best interest to ECPD to keep the accrediting organization as a separate entity." He added that "I just see no advantage to consolidation of these two groups."

The American Society of Civil Engineers has given its approval of the merger plan, with modifications. The American Society of Mechanical Engineers reports "no final action," but everyone expects its approval of the merger — perhaps also with modifications.

The American Institute of Chemical Engineers and the American Institute of Mining, Metallurgical, and Petroleum Engineers are giving unqualified approval to the current merger proposals.

Elsewhere on the unity front, AIEE and ASME were the only Founder Societies having officials attending a recent convention of the National Society of Professional Engineers. Late last year, NSPE invited all Founders to send observers to NSPE meetings in the interest of unity.

In regards to the Birmingham NSPE meeting, ASME made it clear that President Glenn Warren was attending merely as a member of NSPE and was not acting in any official capacity.

However, Hickernell reported that W. R. Brownlee was officially representing AIEE at this session. "We plan to make the representation of AIEE as a regular occurrence at future NSPE meetings," the AIEE president added.

Proportionate Voting

The American Institute of Electrical Engineers has decided the larger organizations, which pay the highest dues to the Engineers Joint Council, should have more of a voice in budget and membership matters. So AIEE has suggested a "proportionate voting" method.

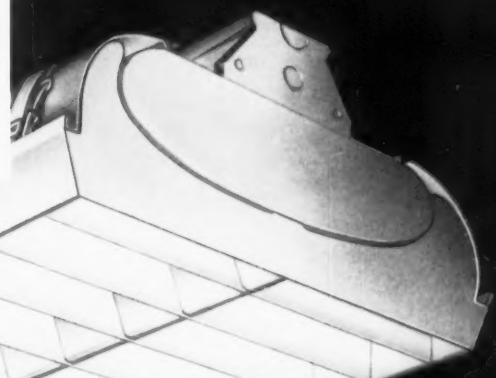
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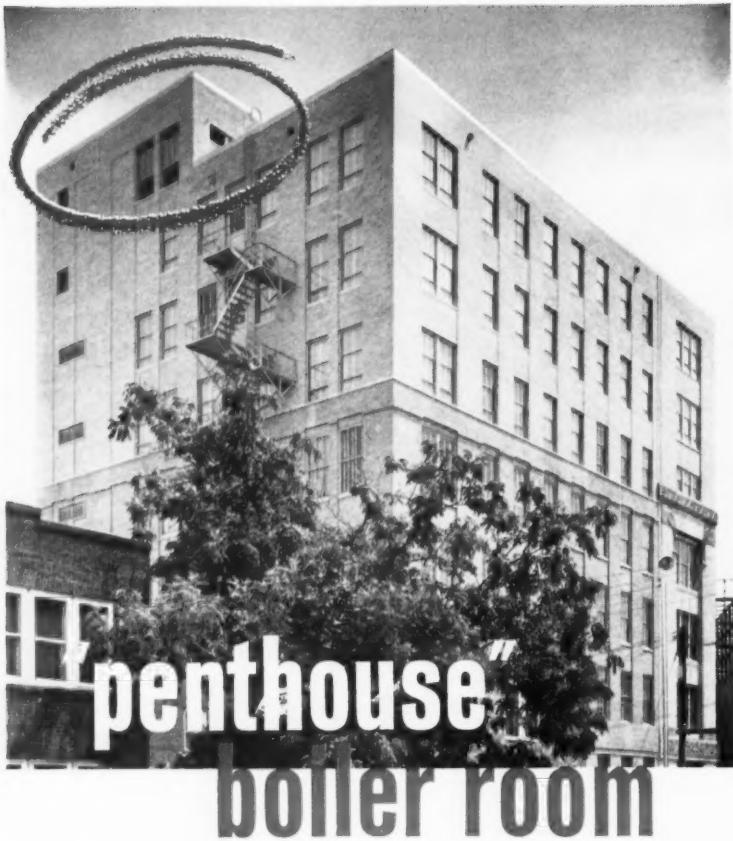
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REPRESENTATIVES THRUOUT THE UNITED STATES AND CANADA



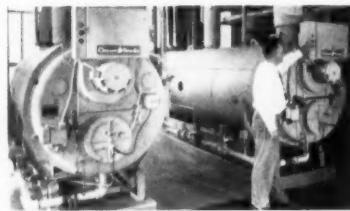
**Cleaver-Brooks boilers at Lone Star Gas Company,
Ft. Worth, Texas, demonstrate advantages of compact design
and reliable, low-cost operation in year-round dual use of steam**

The installation — these two Cleaver-Brooks 100-hp gas-fired boilers in penthouse boiler room atop eight-story office building, according to A. E. Emmet, Industrial Engineer, "are providing all steam needed for both heating and cooling of the entire building."

The advantages — "So compact are these CB boilers, we have almost five times the steam capacity in our penthouse that we had in an equivalent basement area. Our choice of 100-hp boilers was dictated by our new 236-ton absorption air conditioning unit which uses approximately 20 lbs. of steam per ton-hour's operation."

Efficiency — Mr. Emmett continues, "Since the Cleaver-Brooks boilers operate at a guaranteed minimum efficiency of 80% (as opposed to the 70% top for former boilers), our operating costs have been reduced about 10%, resulting in significant fuel savings per unit of steam produced."

"Further, the CB boilers guarantee 99% dry steam. Also, un-



Lone Star's two Cleaver-Brooks boilers are Model CB-700-100, 15-lb. design . . . deliver consistent, trouble-free service — 3000 lbs. per hr. in summer, 1000 lbs. per hr. in winter.

divided responsibility for the design of a package-type boiler always works out to the customer's advantage and all parts are built to work as a unit."

Cleaver-Brooks packaged boilers simplify installation, cut operating costs. For complete information, write Dept. D, 321 E. Keefe Ave., Milwaukee 1, Wisconsin.

Cleaver Brooks
ORIGINATORS AND LARGEST PRODUCER
OF PACKAGED BOILERS

one constituent society, regardless of size) is used now, the Electri-cals would like to see one vote per 10,000 members allotted to the constituents. "After all, we provide 22 percent of the EJC funds. It seems only fair to me that we have more to say in how this money is spent than does some small constituent society, which has — maybe — a \$75,000 total budget," explained L. F. Hickernell, AIEE president.

Under the proportionate voting method, the five Founder Societies would have enough votes to pass a resolution. Action could be blocked by only two of the Founder Societies. But early barometer readings around headquarters indicate that the AIEE proposal is not likely to get very far.

New Scope

The engineering division of the American Road Builders' Association has prepared a report called "Scope of Engineering Services Performed by Consultants on Express Highway Projects In the U.S.," to be used as a supplement to the American Society of Civil Engineers' new fee schedule — Manual 38.

Prepared as an aid to anyone not fully aware of the range of engineering services required in the formulation and execution of plans for modern expressways and as a means of cross-checking fees proposed in the ASCE Manual, the ARBA report has been circulated to members for suggestions and/or approval.

Included in the tentative definitions of scope are detailed discussions of such things as traffic studies, route location, engineering design, surveys and base maps for final design, preparation of contract plans and documents, and supervision of construction.

The ARBA also has taken a recent survey of contractors to study their problems and their capacities.

The study showed that contractors expressed concern over mount-

Architect & Contractor see for themselves

HOW BEATTY-PECCO HORIZONTAL SHORES CUT CONCRETE FORMING COSTS



JOB: STATE HQ, CALIF. TEACHERS ASSOC.

CONTRACTOR: SWINERTON & WALBERG CO.

ARCHITECT: WELTON BECKET & ASSOC.



Field tested by the contractor *before* actual construction began, Beatty-Pecco Horizontal Shoring proved to be the *economical* choice. Above you see 30" Pan Construction (equal to 6" slab) taking place. Beatty-Pecco Spans eliminated practically all the vast jungle of vertical supports necessary for conventional methods.

Wide clear aisle spaces were available throughout the building so that while concrete was being poured above, sub-contractors could work without interference on air conditioning, plumbing, heating, etc. More time economy!

For the architect-engineer, Beatty-Pecco Horizontal Shoring helped provide specified results—concrete structural excellence. Rolled-in camber, which resets automatically, assured that concrete poured would set correctly.

If you're a profit-thinking architect, engineer, or contractor, you'll want to see for yourself how Beatty-Pecco Horizontal Shoring can reduce costs. No obligation for data and information.

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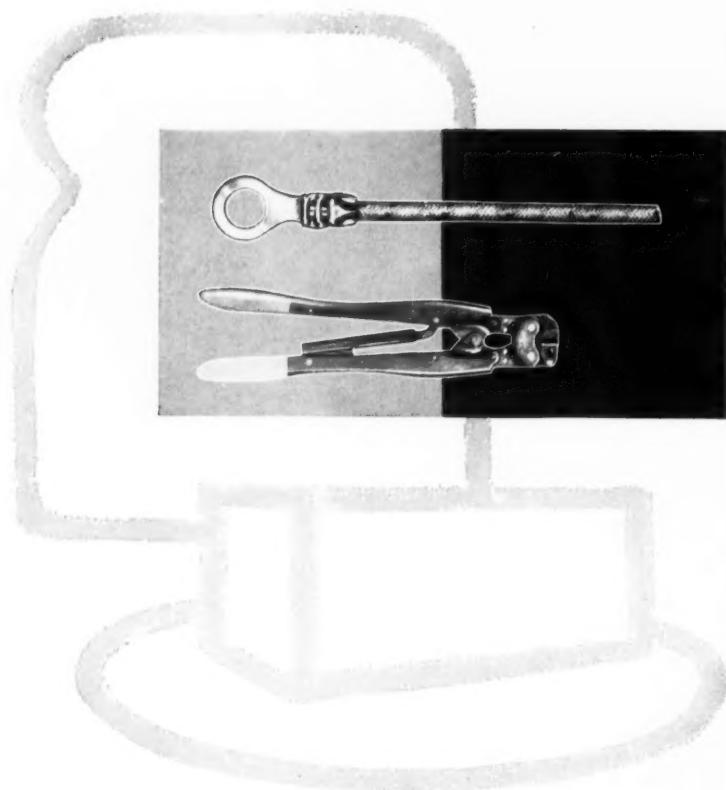
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Reliability and lowest cost also go together like bread and butter in this A-MP tool and terminal method. There are no hidden "caviar" costs or doubtful connections. In fact, total installed cost is lower than any other terminal-attachment method, while the entire termination operation is mechanically quality-controlled to create the highest reliability in the finished product.

In addition, AMP manufactures a more diversified line of termination products than any other firm in the world, ranging from top quality circuit terminals and splices to versatile multi-circuit units for the most complex electronic components.

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ing delays in the awards of contracts, with many suggesting that the paper work could be done before bid opening. A majority expressed satisfaction with photographic techniques being used to expedite the reproduction of plans from pencilled drawings. And contractors in more than half the states reported that current specifications require them to use methods of equipment which they would not otherwise have chosen to perform various items of work. Most complaints along the latter lines were in regard to compaction and paving work.

The most frequent suggestion to facilitate contracting operations was for more authority to be delegated to the field so that the project engineer could make important decisions right on the job.

Surveyors Are Engineers

Land surveying, engineering surveying, geodetic surveying, and cartographic surveying now are a part of the civil engineering profession. The ASCE Board has recently so ruled.

Because of a number of recurring problems, an ASCE task committee began a study in 1954 to decide just where surveyors fit into the engineering profession. Among the many factors that caused the study to be scheduled were government groups, on all levels, seeking to retain surveyors on a basis of competitive bidding. Often, corporations also were bidding on the preparation of topographic maps. It was difficult for ASCE to make accusations of unethical conduct when there was no policy statement as to whether surveyors were professionals or technicians.

So surveying was divided into:

"Professional — Work that involves the exercise of professional judgment, frequently based on knowledge acquired through higher learning, generally nonroutine in character. The term implies one who can plan, perform, and/or direct all such operations in the cate-

Here's the school communications system that makes sense... by making one conduit do the work of 3, 4, or even 5... by sensibly and economically combining several functions to provide more value for less money... by making possible the economical installation of a "basic" system now, with provision for low-cost add-on of future services.

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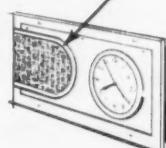
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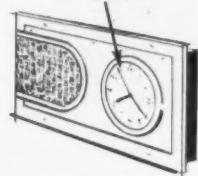
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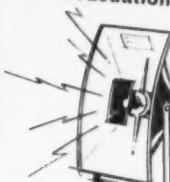
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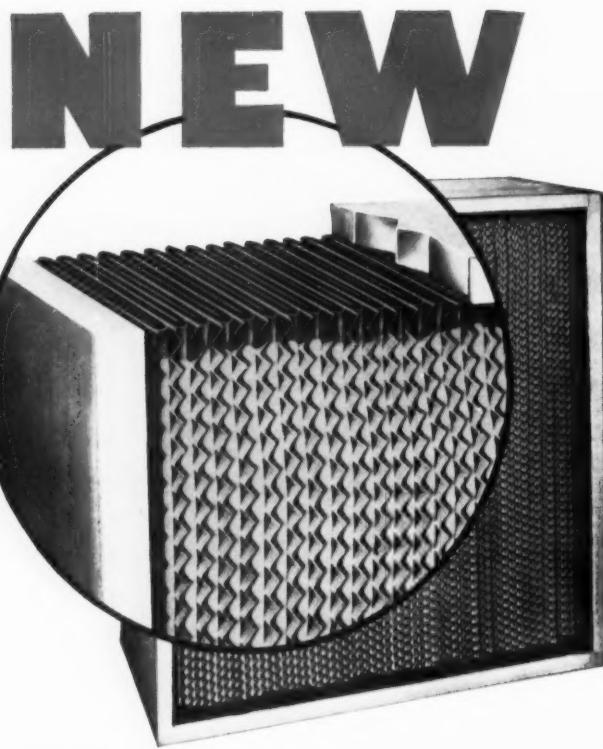
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MICRETAIN Series ABSOLUTE® Filter

- Initial Pressure Drop 0.4" w.g.**
- Efficiency 95% DOP Test
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With an efficiency of 95% on 0.3 micron particles and of 99% by the discoloration test using atmospheric dust, the new MICRETAIN series of ABSOLUTE filters offers extremely high efficiency at an initial pressure drop of only 0.4" w.g. Life tests to a final pressure drop of 1.0", using 100% outside air and without prefilters, show a service life of at least 4000 hours.

Using a chip board frame, a special new glass-asbestos filter medium and sturdy Kraft separators, the new MICRETAIN Model 7A-1000 filter packs a capacity of 1000 CFM into a face area of 24" x 24", with a filter depth of 11½". Self-supporting — no frame required.

Ideal for hospital operating room supply systems, the MICRETAIN filter is 97% efficient in removing nebulized staphylococcus aerosols, and essentially 100% efficient in removing bacteria attached to dust particles.

Special materials available for high temperature, high humidity, and fire and corrosion resistance.

Write for Bulletin 142



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gory; this person is responsible for work done by those under him.

"Technical level — Work that is primarily routine, of a technical nature, often demanding a higher degree of skill, done under the direction of a professional person who is responsible for its outcome. Such work is preprofessional when performed by a professional trainee who, having completed courses of specialized intellectual instruction and study, is seeking to attain professional status."

A study of engineering registration laws showed the status of the surveyor currently varies with the geographical location. Some states, such as Pennsylvania, specifically include surveying and mapping in the basic definitions of professional engineering. Other states have no reference to surveying and mapping. And in some places, attorney generals have excluded all or parts of surveying from engineering and the requirement from licensing.

"Since a lack of uniformity of state laws and rulings exists, the Task Committee felt that the basic definition and resolution of the professional status of surveying and mapping should emanate from the engineering profession itself. When the engineers have placed surveying and mapping in its proper professional position, a positive statement can be made to the licensing boards to attain legal recognition," the committee concluded.

One danger of a joint surveying-engineering license was pointed out by the committee. Because of platting laws, recording laws, and other specialized knowledge needed by surveyors, the committee cautioned engineers to "be very careful . . . in judging their own competency to practice property surveying. This will require a renewed sense of ethics within the profession, but we are strong in the belief that without such a proper ethical basis a profession cannot exist."

Some problems remain to be solved. The prospects of requiring



Evansville, Ind., Sewage Treatment Plant has two Climax V-85 and three Climax V-80 eight cylinder engines driving the sewage pumps.

CLIMAX ENGINES POWER the PUMPS

- Driving the Evansville, Indiana, sewage treatment plant's Worthington vertical sewage pumps through right angle gears at 720 rpm, 70 lb. BMEP, are five Climax eight-cylinder, 60-degree V-type sewage-natural gas engines. Two are 2474 cubic inch Climax V-85 model, 7 $\frac{1}{2}$ -in. bore x 7-in. stroke; and three are 2155 cubic inch Climax V-80 model, 7-in. bore x 7-in. stroke. Equipment includes dual ignition, air starting, Viking pump, Sarco blender, oil bath air cleaner, Honan Crane oil purifier, Synchro Start ALS control and automatic fuel switchover.

The unusual compactness of Climax V-8 design means more power packed into less space. Rugged too, for durability with dependability in continuous duty sewage plant service.

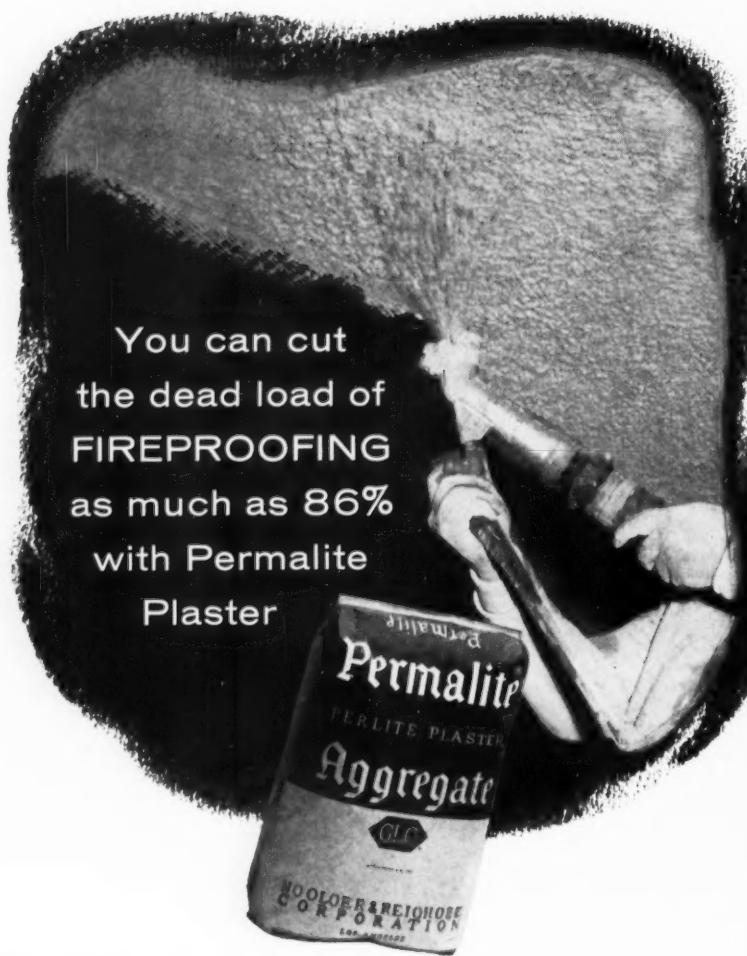
Fuel economy is built-in. All the Climax plus-value operational features are described in Bulletin SA-584—send for it.

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WEIGHT? An example— $1\frac{3}{4}$ " thickness of Permalite plaster on self-furring metal lath gains a 4-hour fire rating...yet on a 10" column weighs only 33 lbs/lineal column foot. The same fire rating gained with concrete requires a 3" minimum thickness, and weighs 249 lbs/lineal column foot.

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civil engineering curricula to include surveying courses, and of what if anything should be added to licensing examinations were referred to committees.

Other ASCE actions also should interest consultants.

¶ The Board has adopted a policy that all public service personnel responsible for engineering design, construction, or other engineering services should be registered engineers. This recommendation also is being forwarded to Engineers Joint Council with a request that EJC take steps to implement the requirement nationally. EJC will be requested to seek the cooperation of NSPE and other organizations.

¶ A coordinating committee on transportation has been created. One of its primary objectives will be to initiate studies and disseminate information on broad transportation policies.

¶ In its recent annual report, ASCE mentioned that instances of advertising for competitive bids have continued to rise, largely because of a lack of client understanding as to the "fallacy of price bidding for professional services."

According to the report, "nearly all major Federal agencies have adopted firm policies for negotiating engineering contracts without bidding. For many years, these have included the Department of the Air Force, U.S. Army Corps of Engineers, Bureau of Yards and Docks, Department of the Interior, Atomic Energy Commission, and Public Buildings Service.

"This year, as a result of ASCE guidance and cooperation, the International Cooperation Administration adopted the same policy. Previously, ICA considered that it was obliged to request 'comparable proposals' for services in foreign countries, but after two years of periodic contact of ICA by the headquarters staff and ASCE representatives . . . decision was reached to abandon the practice."

¶ The Committee on Professional Conduct considered 14 cases in



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*New Houston, Texas home of Southwestern Industrial Electronics Co., a Division of Dresser Industries. Shown above: E. L. Andrews, Facility Director for Dresser Industries, Inc. Consultants: Bernard Johnson & Associates; Weldon W. Henderson, Consulting Engineer. Architects: Pierce & Pierce.



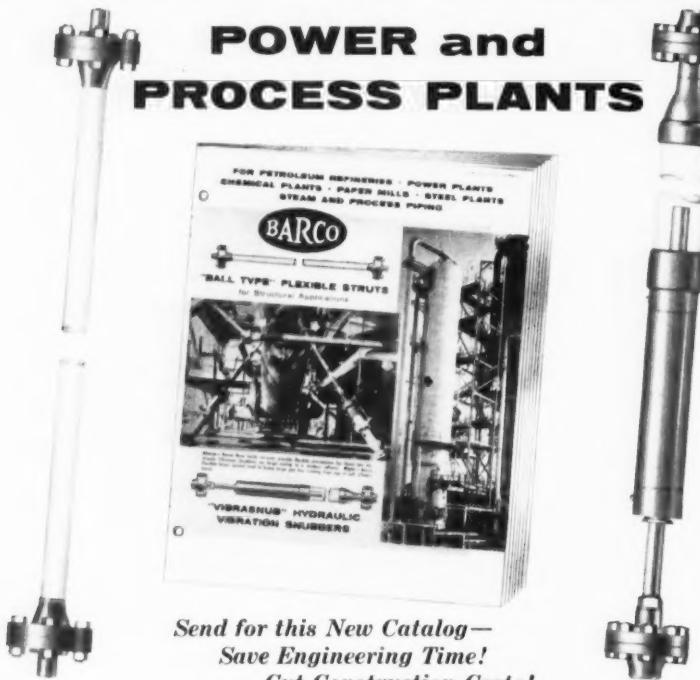
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- **Hydraulic**
- **Vibration Snubbers**

- Immediately available from stock
- and readily adaptable to economical field use for handling rapid shock loads and restricting vibration in hot piping. Typical applications are in high temperature piping in steam plants, petroleum refineries, and process plants. The "Vibrasnub" readily allows thermal movements, but effectively restricts rapid vibration movements and momentary shock loads such as may cause dangerous stresses, annoying noise, or deterioration in structural assemblies.
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SEND FOR NEW CATALOG 229A—Illustrated with drawings and photographs showing how to reduce design engineering time and save on structural costs with new Barco "Ball Type" Flexible Struts and "Vibrasnub" Hydraulic Vibration Snubbers.



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1958. Three of these were continued for further information, nine were dismissed on the grounds that investigation did not substantiate the charges, and two letters of admonition were sent.

As in the past, the cases involved: (1) alleged damages to the professional reputation of another engineer, (2) attempts to supplant another engineer on a project, (3) participation in bidding on a price basis for professional services, (4) bribery, (5) perjury, and (6) income tax evasion.

The ASCE annual report, which has been distributed to the membership, shows a steady growth since World War II, when the membership was about 21,000. Membership of the 106-year old Society now stands at an all-time high of 41,377—a growth of more than 1350 over the previous year.

Leaves Nuclear Congress

In an effort to decrease the number of annual meetings on atomic energy, the Atomic Industrial Forum has withdrawn future support of the Engineers Joint Council Nuclear Congress and will hold separate meetings . . . (?)

"In 1958 the Forum Memo listed the holding of more than 40 national meetings on atomic energy in the United States, and there are no signs that there will be any fewer this year," a recent Forum letter told members. "This number can only mean a great deal of duplication of material reported on, and can't help but be a heavy financial and time drain upon an industry which is struggling hard to meet expenses."

After last year's Nuclear Congress, the Forum executive committee decided that the EJC Nuclear Congress had an unwieldy organizational structure. So this year, the Forum will hold a conference Nov. 2 through 4 in Washington, D.C. At the same time the American Nuclear Society also is meeting in Washington's Sheraton-Park Hotel. Some of the sessions will be



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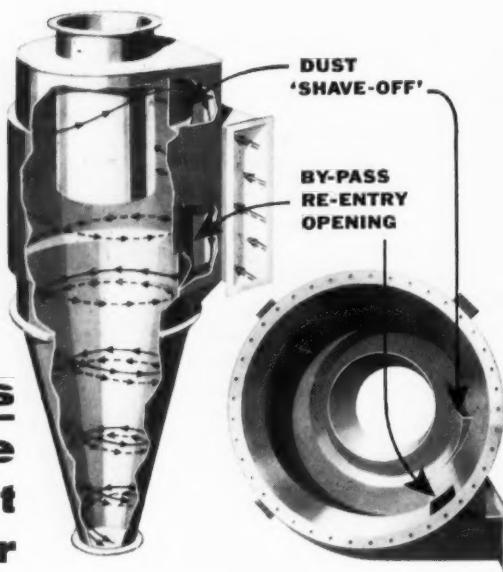
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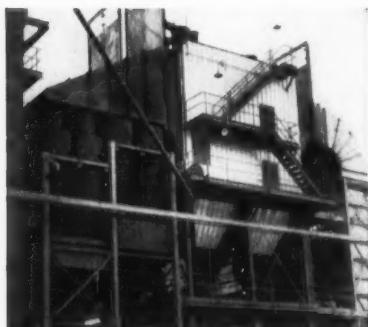
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jointly sponsored. Joint Forum and ANS meetings also are scheduled for December 1960, in San Francisco, and in New York City in 1961. At the latter meeting, the holding of an Atom Fair also will be resumed.

Parker Elected

Newly elected president of the Association of Consulting Engineers of Canada Inc. is C. C. Parker, of Hamilton, Ontario, who succeeds J. G. Frost, of Montreal.

Second phase of the Association's annual meeting is scheduled for June 8, Toronto, to coincide with the annual convention of the Engineering Institute of Canada.

And closer to home . . .

Minnesota — At a policy committee meeting, it was agreed that the Consulting Engineers Council should concentrate on a larger budget through increased membership rather than through increased dues. More discussion on this subject is slated.

The ethical practices committee is preparing a code of operating ethics to clarify the "do's" and "don'ts" of present codes.

Illinois — Copies of a recently proposed bill were circulated. This bill would place the registration of engineers and architects under the jurisdiction of a Department of Labor and Industry, which would replace the present Code Department of Mines and Minerals and the Department of Labor. Consulting engineers in Illinois are not expected to like the idea of supervision by a department handling labor affairs.

Iowa — A revised schedule of minimum fees for consulting engineers has been compiled by the Iowa Association of Consulting Engineers and the Iowa Engineering Society. The schedule currently is being reviewed by the two groups.

Compounded Error

On Jan. 2, Radnor J. Paquette, civil engineering professor at Georgia Institute of Technology, sent letters

Sewage Pump Well Elevation Held at 114.5'±3" Despite Big Variations in Flow



Three of four E-M 200 hp, 1200 rpm Vertical Synchronous Motors with Adjustable-Speed Magnetic Drives at Nut Island Sewage Treatment Plant of the South Metropolitan Sewage System in Quincy, Massachusetts.

E-M Vertical Synchronous Motor and Magnetic Drive Unit for adjustable-speed power transmission to vertical centrifugal pump. The ring element (1) mounted directly on the motor shaft turns at motor speed. The magnet element (2), mounted

inside the ring element, has no mechanical connection to the motor . . . torque is transmitted through magnetic flux linkage between ring and magnet. By varying amount of excitation to magnet, pump speed can be precisely controlled.

AMAZINGLY PRECISE CONTROL OF SEWAGE PUMPS OBTAINED WITH E-M ADJUSTABLE-SPEED MAGNETIC DRIVES

One of the critical problems in operating Boston's new Nut Island Sewage Treatment Plant is complete control over the wide daily, weekly or seasonal flow variations. For example, flows may vary from 63 mgd to 249 mgd, with peak loads of nearly 300 mgd during stormy periods.

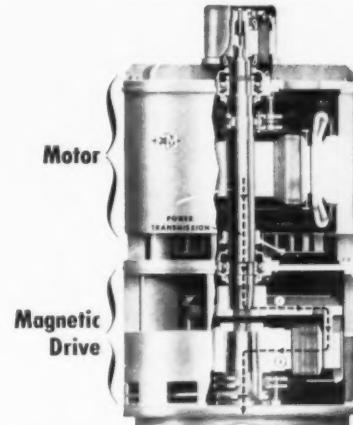
The pump well has to maintain an elevation of 114.5 feet with not more than 3 inches variation, to assure proper levels and flow velocities in the sewage processing channels. Control of the output of the low-lift sewage pumps has to be fast and remarkably accurate.

Use of E-M Adjustable-Speed Magnetic Drives for the low-lift pumps provides the sensitive speed control necessary in maintaining this close command of the pump well elevation.

Pump speed changes are dictated by a well float that actuates the Magnetic Drive through an E-M "Regutron" Control. Pump speed is automatically increased or decreased to maintain precisely the required pump well elevation. The Magnetic Drives are highly important and effective factors in most efficient operation of the Nut Island Sewage Treatment Plant for eliminating pollution in Boston Harbor.

For more information, see your nearest E-M sales engineer. And write direct for a copy of E-M Synchronizer No. 38 which tells the complete story of this outstanding installation.

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to a number of consulting engineers soliciting projects. These letters were sent on American Road Builders' Association stationery, and Paquette signed the letters with his title — President, Educational Division, ARBA.

The letters stated:

"We are interested in doing work in bridge and roadway design, and we would appreciate it very much if you could direct clients to us for jobs that you feel are too small to bother with. We are in a position to do some subcontract work for your concern. Our staff is also capable of doing structural design of industrial plants, commercial buildings, institutions, and related work."

"If there is a possibility that you may have something for us, we could arrange to have an engineer contact you."

On Jan. 9, Louis W. Prentiss, executive vice president of the ARBA, heard about the letters. He sent out an announcement that:

"It came to my attention that

the president of the Educational Division of ARBA has been soliciting engineering work for his recently organized firm, on the stationery of the association, from member firms of ARBA's Engineering Division. This was the first knowledge I, or any member of my staff, had of this unfortunate and unauthorized action.

"... I instructed him (Prof. Paquette) to cease and desist from any further such solicitation on ARBA letterhead or in using ARBA's name in any manner whatsoever in connection with his personal business.

"Professor Paquette advised me that he had mailed about fifty such letters. Whereupon, I asked him to write a letter to each of the parties so solicited, explaining that the American Road Builders' Association had no previous knowledge of his solicitation and emphatically disapproved of his action. Professor Paquette agreed to do this at once and expressed regret over the em-

barrassment to the American Road Builders' Association."

So Professor Paquette wrote the letter suggested by Prentiss. The apology was written on ARBA stationery and signed "Radnor J. Paquette, President, Educational Division, ARBA."

"Exchange Program"

The American Institute of Chemical Engineers, through its newly created Institute Machine Computations Committee, is seeking to facilitate the use of computer equipment by members.

F. J. Van Antwerpen, AIChE secretary, explained that programming is one of the most expensive aspects of using computers. Why should two AIChE members each spend a large sum for programming the same information?

All abstracts submitted must include data on methods of calculation used, assumptions and limitations of the program, and the type of computer for which the program was devised.

The service was set up after an Institute "ad hoc" committee found that "virtually no interchange exists for computer programs which have direct use to chemical engineers," and that "some form of cooperative effort is necessary if the (chemical) process industries are to make satisfactory progress in harnessing the new computer tools available to them."

Wood Standards

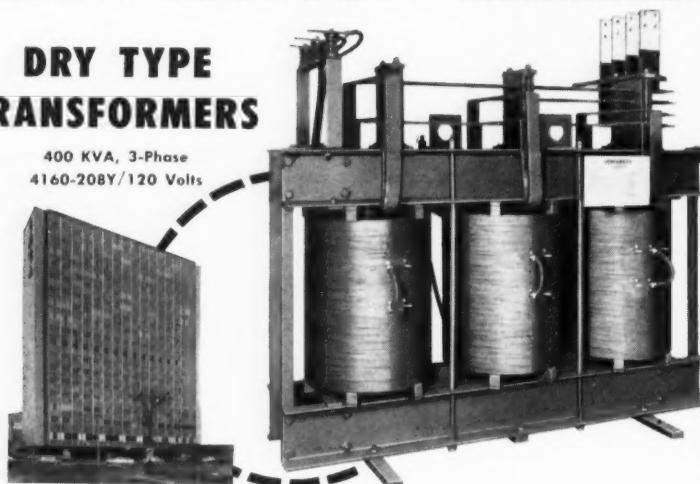
The American Standards Association is canvassing producers and users of wood to see if they think there is a need for international standards on wood and plywood, and if so, if the U.S. would participate in setting them up.

The Portuguese standards body suggested an international agreement on characteristics and nomenclature of wood. The German national standards group proposed the study of international standards for both plywood and various types of particle board. ▲▲

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Durable chromium plated seamless steel sleeves. No chance of metal fatigue. Wrought steel bases provide rugged, positive anchorage.

- **INTERNAL AND EXTERNAL GUIDES**
Positive alignment of sleeve in stuffing box —where it counts!

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Many Gun-Pakt joints have been *in service* over 25 years with only nominal maintenance—no major repairs or periodic overhauls. Maintenance costs are negligible—records show average to be one manhour and 65 cents worth of packing per joint per year. AND—NEVER A SHUTDOWN FOR REPACKING!

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Electrical Systems for Jet Engine Testing



JAMES T. HOWLEY,
P. Eng., Chief Electrical Engineer
Giffels & Vallet of Canada, Ltd.

DOUGLAS R. KINSMAN,
P. Eng., Electrical Design Engineer
Giffels & Vallet of Canada, Ltd.



James T. Howley, P. Eng., studied at St. Bonaventure's College and Memorial University College in St. John's, Newfoundland and at Nova Scotia Technical College, Halifax where he received his B. Eng. (Elec.) degree in 1935. He then went to Oxford as a Rhodes Scholar, earning a B.A. (Eng.) degree in 1939. Howley's professional experience includes service with Bowater's Newfoundland Pulp & Paper Mills; Defense Industries Ltd., Montreal; Canadian Industries Ltd., Montreal; Dominion Tar & Chemical Co., Ltd., Montreal; and Atomic Energy of Canada, Ltd., Chalk River. In 1956, he joined the Windsor staff of Giffels and Vallet of Canada, Ltd., where he is chief electrical engineer. Howley is a member of the Association of Professional Engineers of Ontario and AIEE.

Douglas R. Kinsman, P. Eng., received his education at the Pelham Continuation School, Fenwick, Ontario and at Queen's University in Kingston, Ontario, where he graduated in 1950 with a Bachelor of Science degree in electrical engineering. He served in the Canadian Army, and was employed by Canadian Comstock Co., Ltd., Frequency Standardization Division; Polymer Corporation Ltd., Sarnia; and Johnson-Turner Electric, Windsor; before joining Giffels & Vallet of Canada, Ltd., in 1955. He is an electrical design engineer.

THE DESIGN of the electrical systems for a jet engine test facility presents the electrical engineer with interesting challenges. Operating conditions are unusual; process and safety instrumentation is complex. Test procedures are developing rapidly; test equipment is being improved; and job requirements alter as the design progresses. The engineer often finds it necessary to collaborate with both client and supplier in designing new equipment.

C_E exclusive

There are areas where conventional design practices can be applied, but the engineer more often finds he is working in a field where there is little past experience to guide him. He has to apply materials in a manner new to the manufacturer. The design work is evolutionary, and the engineer must rely on fundamental concepts.

Our firm, Giffels & Vallet of Canada, Ltd., recently completed work on the electrical aspects of a jet engine test facility. The number of projects



Central recording room, as shown in the two photos at the left, was illuminated with recessed fixtures providing soft, glare-free lighting. Overall lighting level, 50-60 footcandles.

of this type is increasing, and other consultants may find our experiences and our solutions of value when they come against similar design problems.

Lighting Requirements

A specific illumination level is required for efficient operation. Beyond this, conditions in each area have to be examined to determine where brightness control, light direction, stroboscopic effect, chromaticity, and other factors are important.

In administrative and maintenance areas, lighting fixtures can be applied in accordance with standard practice and are selected on the usual basis of suitability and economy, in installation, operation, and maintenance.

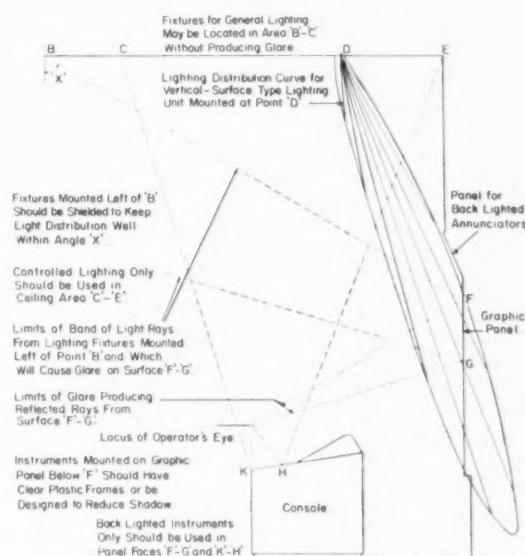
In any jet engine test facility, a control room is associated with each test cell. In control rooms, lighting is critical. Testing of a jet engine requires a multiplicity of indicators and gages of a variety of types and styles, and glare and reflection on these instruments must be avoided. The optimum lighting layout combines a low-brightness, well-diffused, semidirect system with back-lighted instruments. However, not all types of instruments are available with back-lighting, and where this feature is not available, clear plastic faces should be specified. Diffused general lighting, rows of fixtures with refracting lenses for vertical-surface lighting, and back-lighted instruments where available, combine quite well to provide good control room lighting. Over-all lighting levels should be 50-60 footcandles. The accompanying sketch shows how the control room and panel arrangement was analyzed for glare and vertical surface lighting.

Our test facility included six test cells, and in addition to each cell's control room, there is a central recording room serving the whole. This type of room also requires special study to avoid glare, reflection, and shadows. However, lighting arrange-

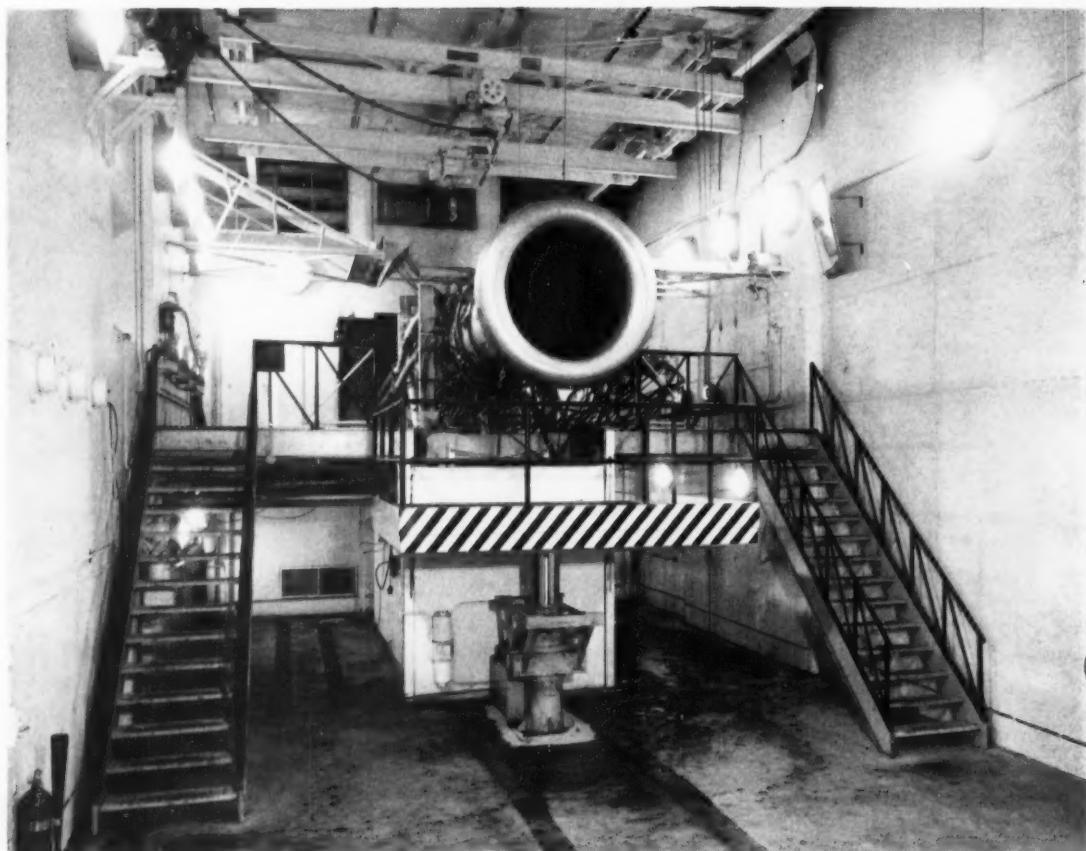
ments similar to those of the cell control rooms is quite satisfactory. Two photographs show different views of a room of this type.

Test Cell Problems

Inside test cells, special lighting problems are encountered. Design temperatures in the cells may be 500 F to 600 F. During the running of a test, the ambient sound power level may reach 180 db, with a consequent sound pressure level of 165 db. Fixtures and wiring must be designed to withstand the temperature and the vibration. They must have shock-absorbing sockets, and reflectors require shockproof mountings and locks. Wiring must be



An instrument lighting analysis means that operators will be able to read instruments fast, accurately.



Rugged wall mounted fixtures provide 100 footcandles inside test cell. View looks down engine bellmouth inlet.

firmly connected and all components must be firmly locked in place.

To reduce the effect of glare and of reflections on the glass of observation windows, fixtures must be carefully selected and located, and an over-all intensity of some 100 footcandles is required. The use of incandescent lighting is dictated by the necessity for color rendition and avoidance of strobe. Where the fixtures cannot be cast into the concrete walls of the test cell, lighting fixtures of heavy cast metal construction, as shown in the photograph of a typical development test cell, are to be preferred for they are less susceptible to vibration damage.

We found it necessary on our project to illuminate the interior of the wind tunnel or test chamber by concentrating the light through a number of small 6-in. diameter armored-glass portholes. The thickness of steel plate reinforcing around the porthole makes it difficult to locate the light center close to the opening. This means that the light beam should be concentrated in a small angle —

about 22 degrees — so that most of the lumen output is not reflected outside of the test chamber. The distribution characteristic of conventional tank lighting fixtures is quite broad, but we found a 150-watt PAR-38 spot lamp projects a beam within the small angle required. These units were installed in cast vaporproof housings. The weight of the cast type housing helps to dampen out high frequency vibration. A photograph illustrates the interior of an altitude test chamber.

Compressor Areas

Test facilities must have a compressor area; mechanical designers tell us that ambient temperatures of about 120 F are to be expected for periods of several hours. Fluorescent fixtures, we found, are not satisfactory under these conditions, for the ballast manufacturers say ballast life would be shortened to approximately three years. Remote location of the ballasts means higher wiring costs. Not only this, but the lumen output of fluorescent fixtures is reduced about 30 percent at this tem-

perature. Industrial type incandescent lighting units seem to be the most logical and economical answer.

In this matter of economics, consulting engineers should keep in mind that the life of a jet engine test facility is relatively short, and obsolescence due to rapid development in the aviation industry makes the amortization rate very high. Therefore, first cost is of relatively greater importance than on a more conventional project where operation and maintenance factors might rule.

Power Distribution

Single-line diagrams provide details of the electrical system used on our project. Distribution of power is most economical at a nominal 600 volts, three-phase, for most facilities. The selection of power cables for main feeders may be complicated by the general layout of the facility. For example, we found that overhead cables had to pass through the compressor area with its 120 F temperature. A depressed area for air ducting and a high water table made routing of underground cables impractical. Our final selection was varnished-cambric insulated cable with a plastic jacket and interlocked steel armor. Feeders were run overhead on steel trusses and in troughs and derated for the ambient temperature. The same type of cable was used for the 4160-v feeders to the 10,000-hp compressor drives, which were routed parallel to the main 600-v feeders in some areas.

Branch circuit wiring to motors and controls is conventional. A standard rigid conduit system can be used. The majority of motor controls can be grouped in motor control centers located close to motor groups. Type B wiring, we found, simplifies control installations, which are likely to be modified many times during construction. Provision for remote or local control with signals should be included in the design.

Emergency System; Special Services

In any high altitude test facility, an emergency power system is required which can provide a transfer of power without any interruption. A loss of power to certain controls, even for a fraction of a second, can result in damage to the system. Standard standby units are too slow in operation, and even with the prime mover and generator running continuously, the break in power during operation of the transfer switch cannot be tolerated.

First, we considered a method of electronic switching, using magnetic amplifiers and saturable reactors, but again the response of the reactors was found to be too slow for the application. Our solution was a "No-Break" unit, consisting of a synchronous motor paralleled with the load and driving a flywheel. On loss of normal supply volt-

age the flywheel drives the synchronous machine as a generator while a diesel engine is started and clutched to the shaft to maintain the supply of emergency power. This emergency power system supplies certain critical instruments, motorized valves, and some emergency lighting.

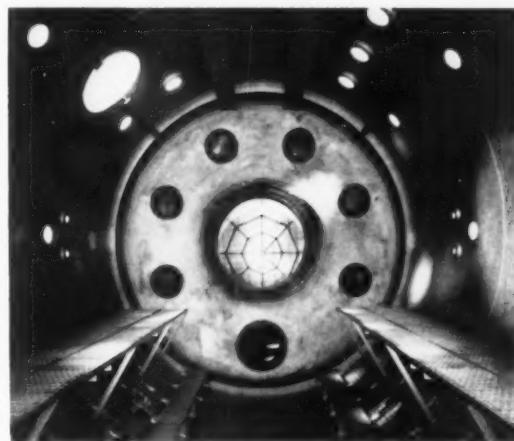
Four hundred cycle ac and 28.5v dc distribution systems also are required for these facilities. A central unit is most economical for these power sources where the test cells are grouped reasonably close together. In addition, an engineer designing a distribution system for a 400 cycle system will find it necessary to use slightly oversized conductors to compensate for increased reactance voltage drop.

Remote control switches should be provided in the main feeders to each power and lighting panel supplying electric power to equipment within the cells. These switches can be controlled from the operator's console thereby providing a means for disconnecting power in an emergency.

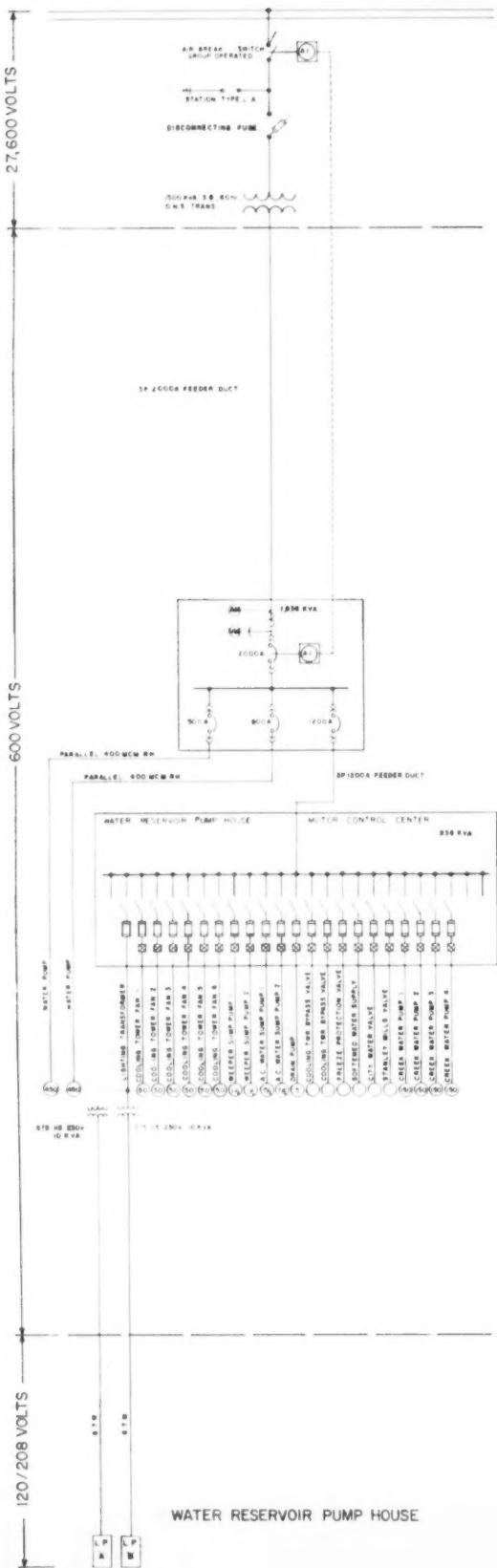
A large number of solenoid valves and releases also are controlled from the operator's console, and for these devices conductors and circuit breakers should be sized on the basis of voltage drop during inrush current to the solenoid.

Climate and Corrosion

Our project is located in the north, and we found it practical to use electric heating in many outlying locations for space heating and for freeze protection where steam was not readily available. It was necessary to electrically heat lengths of 8-in. piping carrying compressed air for starting the jet engines. The temperature of the air, for proper operation, had to be held at a minimum of 325 F. A mineral insulated heating cable was the only type avail-



Altitude test chambers are illuminated by 150-watt PAR-38 spot lamps in 6-in. armored-glass portholes.



able in lengths and resistance characteristics suitable for the application. The cable, however, had a copper sheath which would begin to oxidize at temperatures above 480 F, leaving a maximum allowable temperature gradient of 155 F between the heating cable and pipe. Heating calculations indicated that proper conditions could be maintained if a wrapping of copper sheeting was applied over the pipe and heating cable before the insulation was put on.

In operation, the flow of heat was restricted by surface films and impurities on the pipe, which accelerated oxidation. To prevent cable failure it was found necessary to keep the loading per foot of cable low by increasing the length and to control the system by means of surface thermostats located close to the cable. In this way we are able to keep the operating temperature of the cable sheath low enough to prevent rapid oxidation. The cable was applied helically to the pipe and covered with the wrapping of copper sheeting before 3 inches of insulation were applied.

Grounding systems must be somewhat more elaborate than for more conventional industrial buildings. If thin wall underground water piping is used, it will be necessary to provide separate ground electrodes for the substations and building structure to avoid corrosion from ground currents caused by water-pipe grounds.

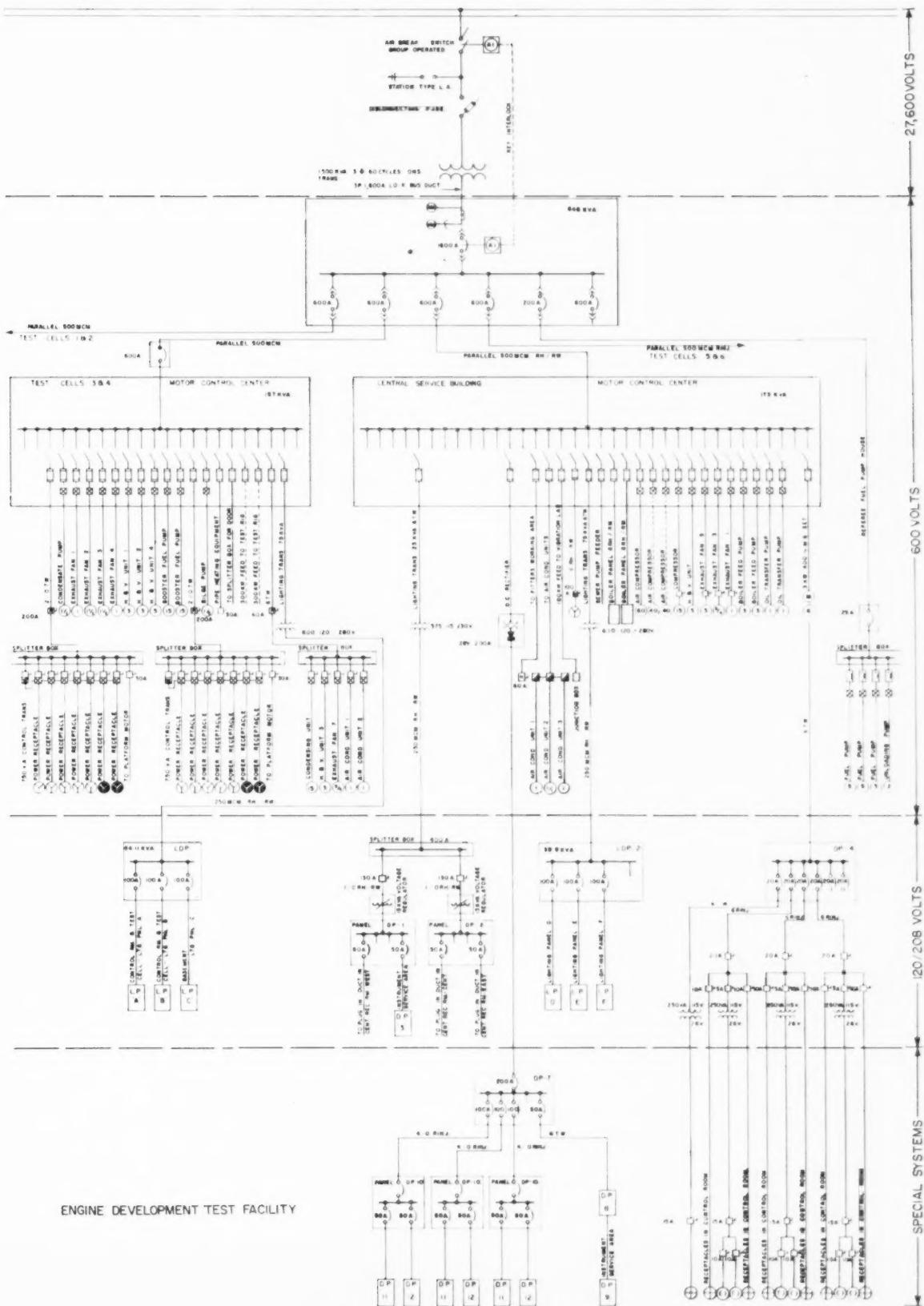
Depending upon soil conditions, a complete cathodic protection system may be required. We found this necessary and specified a system which operates continuously to maintain all piping at negative pipe-to-soil potentials.

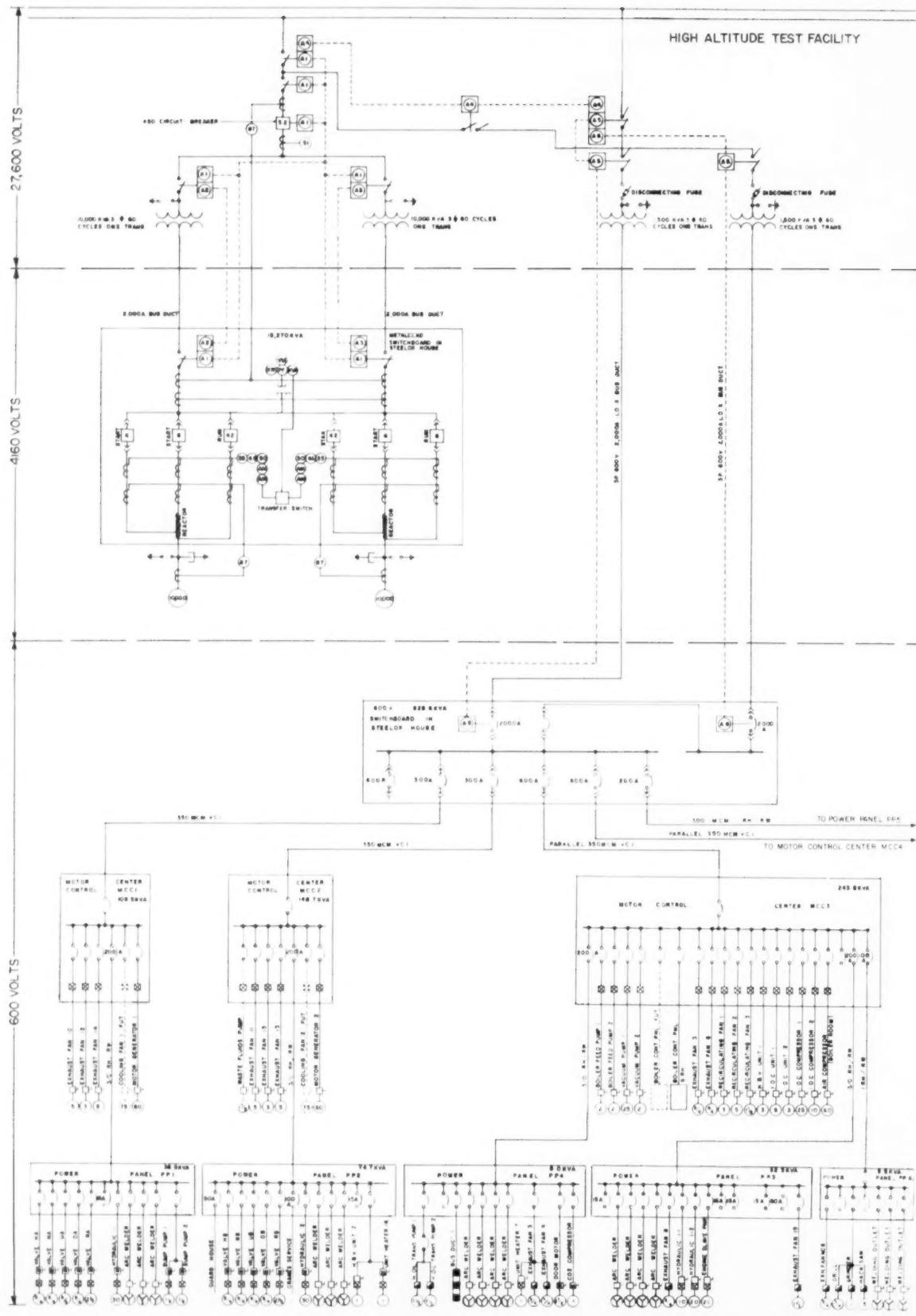
Bus bars must be provided around the perimeter of the test cells and control rooms for grounding of portable equipment, and all flanged fuel pipe connections should be bonded with copper jumpers to avoid build-up of static electricity.

Continuous grounds must be provided throughout control cable troughs and trenches. Aluminum ground cables should be clipped to aluminum troughs at close intervals to prevent induced voltages from developing in the trough system.

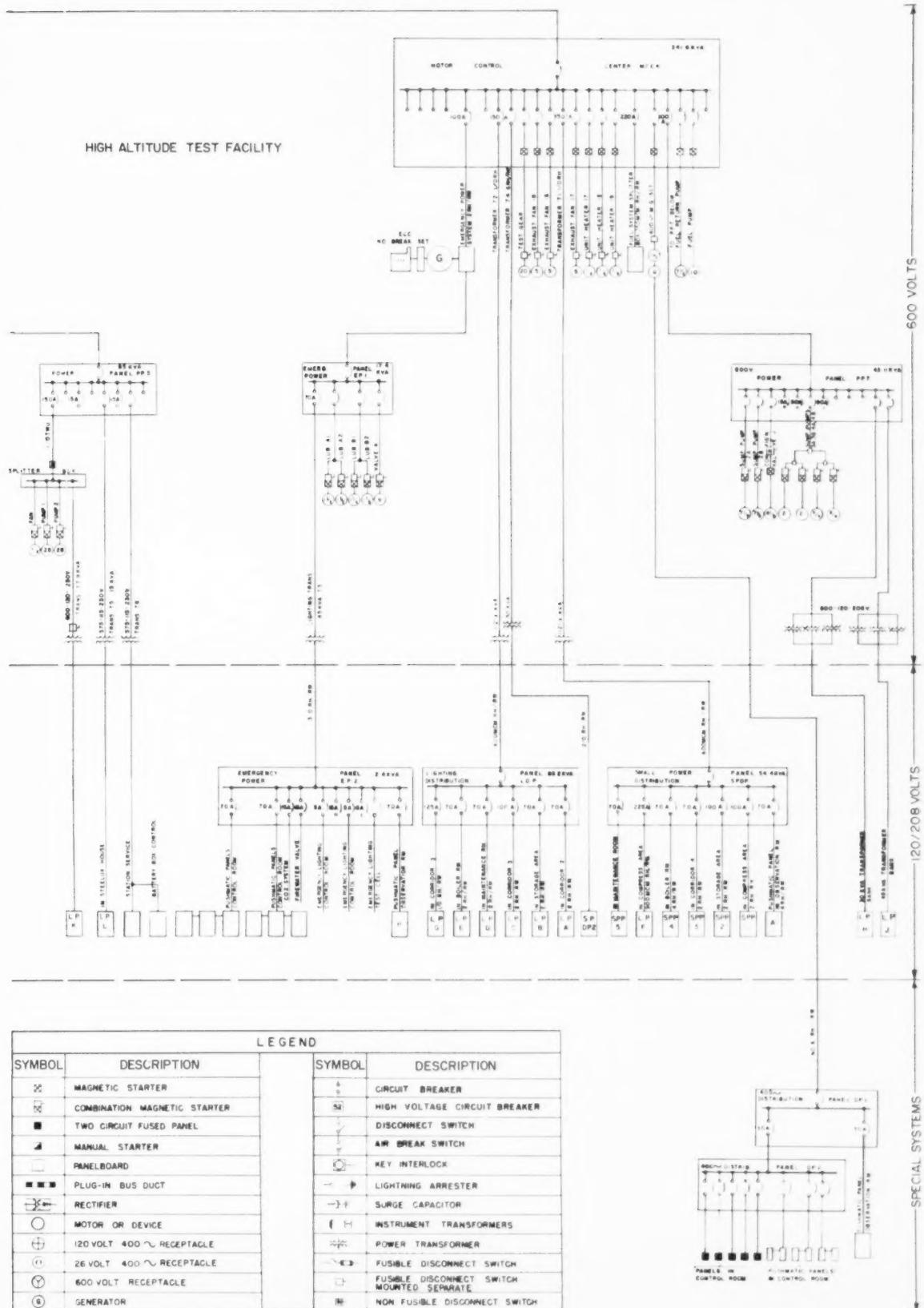
Careful Approach Necessary

It might be mentioned that there is some hazard in the application of fundamental concepts. Simple solutions often may be provided, but the engineer may lose track of the over-all picture and restrict his material selections to the point where expense and delivery become prohibitive. The pace of development, design, and construction is such that catalogued material should be used wherever possible with minimum modification when safety and efficiency are not jeopardized. After all, engineering is applied science plus applied sense. ▲ ▲



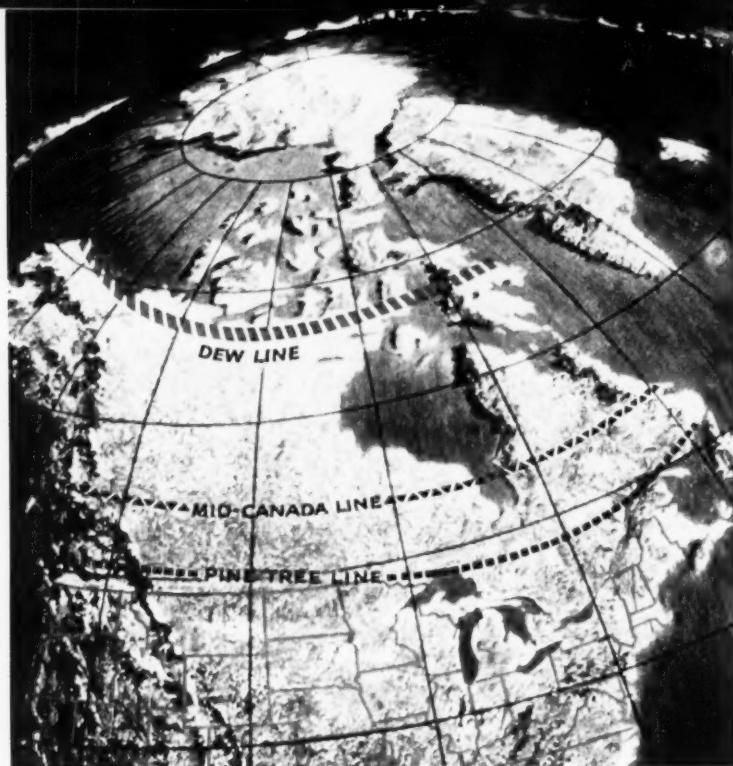


HIGH ALTITUDE TEST FACILITY



Arctic Airstrips Call For Special Handling

Three radar picket lines now guard polar air approaches to the American continent.



STEPHEN D. TEETOR

and

STANLEY ROSANOFF

Seelye Stevenson Value & Kencht



Stephen D. Teetor received his B.C.E. degree from Cornell University in 1943 and had a wartime tour of duty in the U.S. Navy before joining

Seelye Stevenson Value & Knecht in 1946 as a structural designer. In 1951, he was promoted to Supervising Engineer, with responsibility for investigations and major foundations, including detailed inspection work with contractors on foundation installations. Teetor was named an Associate of the firm in 1953, with responsibility for foundation investigations of all types. He became a Partner in 1955.

Stanley Rosanoff studied engineering at CCNY and The Cooper Union. Prior to joining Seelye Stevenson Value & Knecht in 1951, he did civil engineering for a New Jersey Municipal Engineer. In the design of twelve subarctic Pine Tree bases and many DEW line installations, Rosanoff used his wide experience in airfields, water supply, sanitation, drainage, and site selection in the field and in the office. As an associate member of ASCE, he serves on its Committee on Adverse Weather Conditions, Subcommittee on Cold Weather Construction.

A VITAL LINK in this nation's security chain was put into operation in July 1957. The DEW or Distant Early Warning line filled a gap through which a sneak enemy bomber attack was possible.

The arctic segment of the DEW line covers 3000 miles along the 69th parallel from Baffin Bay in eastern Canada westerly across the top of the North American continent to the northwest tip of Alaska.

On the continent the DEW line is backed up by the 2700-mile long Mid-Canada line and along the United States-Canadian border by the Pine Tree line. These three lines are capable of providing information relative to distance, direction, height, and speed of any aircraft detected.

The DEW line, built by Western Electric Company for the USAF and now maintained and operated by Federal Electric, consists of a series of

electronically interlocked radar stations designed to give us in the continental United States 4 to 6 hours' warning of impending enemy attack, which notice is so necessary to our survival as a nation.

The services of a number of consulting engineers were used on this project, and our firm, Seelye Stevenson Value & Knecht, was employed to assist and advise on the construction of the airstrips and related facilities of the DEW line. In doing reconnaissance, members of this group worked under extremely adverse conditions, typified by a 25,000-mile trip, at temperatures ranging in the minus 30's, with an hour or two of twilight per day. That trip was made in five weeks in arctic bush planes — in the unfavorable weather of early winter.

Arctic Weather

Weather is more than a topic of conversation in the arctic, and an understanding of climatic conditions in the far north is necessary to appreciate arctic engineering and construction.

Initially, men were flown into the project areas in the spring of the year in small bush aircraft, which landed on the ice or snow at each prospective site. Small tractors, parachute dropped or flown in, then were used to prepare airstrips to accommodate larger aircraft, which delivered equipment of greater capacity. The aircraft accommodations grew progressively larger with the size and amount of equipment supplied until most of these strips, carved out of ice and snow, were able to take C-46s and C-47s, thus permitting the easy transportation of men and heavy materials.

In summer, with the melting of the snow and ice strips, permanent airstrips and roads became a necessity. It was for the building of these permanent facilities that our firm's engineering teams were



Permafrost is a subsurface permanently frozen layer. This photograph shows a permafrost strata revealed after the side of the knoll had been bulldozed away.

sent into the field to locate accessible sources of construction materials. The idea was to make the maximum use of local materials and to establish standards for the minimum acceptable airstrips. On the return of these men, material specifications and designs were prepared.

The building of airstrips in permafrost regions involves construction methods and theoretical considerations substantially different from similar projects in more temperate zones. If the permafrost remains frozen, these special problems are minimized; if the permafrost melts as a result of natural or artificial causes, then very serious problems arise.

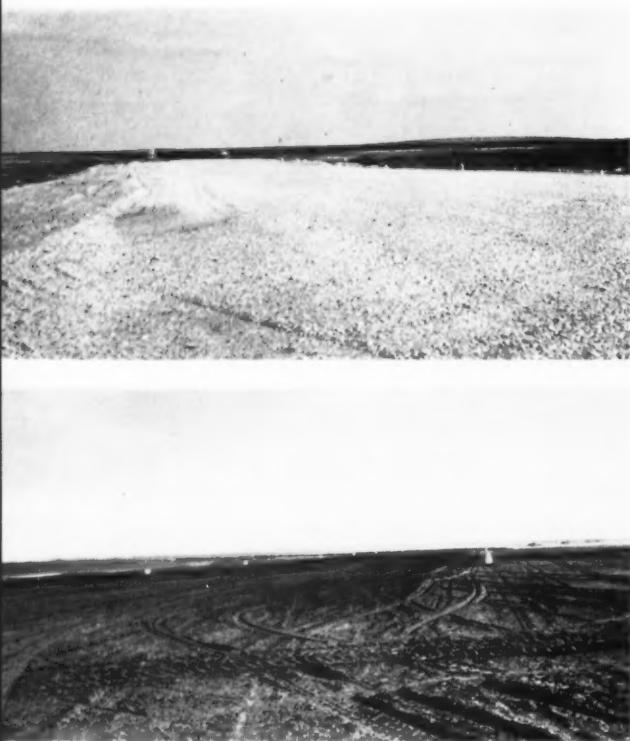
Permafrost is found at varying depths below the ground surface. In this underground region, below freezing temperatures have existed for thousands of years. The top few feet of permafrost, called the active zone, freeze and thaw seasonally, but below this there is normally only permanently frozen material. Where nonfreezing materials such as gravel are encountered, the active zone is seldom more than five feet in depth. Where tundra and peat moss are found, these materials insulate the earth, decreasing the maximum depth of thaw to about two feet.

Construction experience and field observations indicate that free draining gravel or sand should be used for the basic airstrip fill, but this material, if clean, unfrozen, and not of a uniform gradation, will not have sufficient cohesion to sustain the loads imposed upon an airstrip. A surface course of a more cohesive nature must be provided.

In order to provide good density and frictional stability in the surface course, both fine and coarse



Snow removal to keep roads open can be an almost continuous operation during winter months in the arctic.



Gravel scraping operation at DEW line site with the completed runway below. Note water to left of runway.

material should be present, with a good distribution of particle sizes. The fine binder material should be predominantly silt or clayey silt.

Specifications

When preparing our specifications, we studied all materials available and provided the contractor with the following ideal materials and descriptions.

Granular Material: Noncohesive gravel, sandy gravel, or gravelly sand should be used for pervious fill and should be mixed with the binder for the surface course.

For pervious fill, grading of material above the No. 40 sieve size is not critical, but to provide good density and frictional stability, there should be both fine and coarse material present with as good a distribution of particle sizes as possible up to the maximum size available — the maximum not to exceed 2½ inches. To provide free drainage and to prevent capillary moisture rise, the very fine material must be strictly limited with less than 2.5 percent passing the No. 200 sieve.

For surface courses, to provide good density and frictional stability, there should be both fine and coarse material present, with as good a distribution

of particle size as possible up to the maximum size available — not to exceed 2 inches. In general, the minus No. 4 fraction should range from 30 to 60 percent (preferably on the low side), the minus No. 40 fraction from 10 to 30 percent.

Binder Material: The binder material is composed of both clay and silt which pass a No. 200 sieve. Coarse materials may or may not be included in this mixture. The grading is not critical, for the combined coarse and binder material can be balanced to provide the desired amount of minus No. 200. However, some plasticity is desirable in order to provide cohesion. Good material, when moist, can be rolled out between the palms of the hand into a cohesive thread about 1/16 inch in diameter. Typical tundra muck is to be avoided, but if it must be used, both the live growth and the spongy root mat overlying the muck must be stripped off and discarded. Even when this is done, tundra muck is not a good binder.

Materials Actually Available

Field investigation of the soils at 16 individual airstrips above the Alaskan Brooks Range showed that there was no stone or gravel of size greater than 2½ inches available within practical hauling distance of any of the strips. Therefore, all strips were constructed of local granular material 2½ inches or less in diameter. In all previous fills the granular material was silt-free or contained so little fines as to be adequately pervious. The surface course at three strips was natural pit run silty, sandy gravel; all other surface courses were made up of artificial mixtures of sandy gravel and binder (silt, clayey silt, or tundra muck) or made use of well graded material containing only a little binder.

At some strips at the easterly end of the line none of this material was available, so at these sites it was necessary to blast off chunks of mountains to be run through the rock crushers to produce material of the desired sizes. At these sites it was possible to adhere quite closely to the theoretically desirable size and type of material.

Construction Methods

In building gravel surface airstrips, preservation of the tundra overlying permafrost is mandatory. Unfortunately, this basic rule frequently is violated in the interests of construction expediency. It must be remembered that the ability of the tundra layer to act as an insulator under a superimposed runway fill has proven a most effective way to maintain the integrity of the permafrost layer, which acts as a good foundation for the airstrip itself. This is equally true where peat moss and muskeg exist.

Haulage vehicles should not be allowed to pass over tundra ahead of fill in traveling to and from



Left, aerial view of airstrip during construction. Right, permanent runway as seen from plane making landing approach. Runways permit year-round operation of heavily loaded C46 and C47 planes supplying the arctic bases.

the source of supply. They must back dump at the forward end of the fill material, and the fill material then must be bulldozed onto the undisturbed tundra until a minimum cover (2 feet of fill if tundra is frozen, 3 feet if tundra is thawed) of free draining material has been placed. Even then, extensive operation should not be permitted over thawed tundra with only 3 feet of fill in place.

Surface Course Placement

Placing of the surface course is equally as important. Assume a good sandy gravel and a good clayey silt are both available, assume that an 80:20 percent combination is optimum, and assume that materials are spread on the strip in these proportions. It is obvious that proper average proportions will mean nothing if there is improper mixing and there remain some pockets of sand-gravel and some pockets of silt-clay. Lack of proper mixing can nullify all previous steps, and the whole project may fail through want of expenditure of a small percentage of time for proper mixing.

It is obviously impossible to achieve perfect distribution of materials throughout the mass, but the nearer the approach to perfect homogeneity, the better the end result. Therefore, mechanical mixing units that will bite to a minimum depth of 8 inches should be put into operation as soon as possible. Disc harrows also should be used.

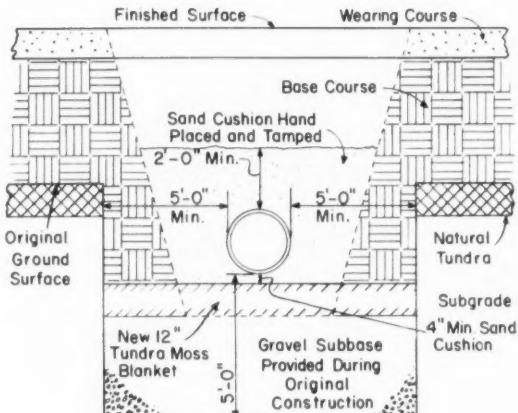
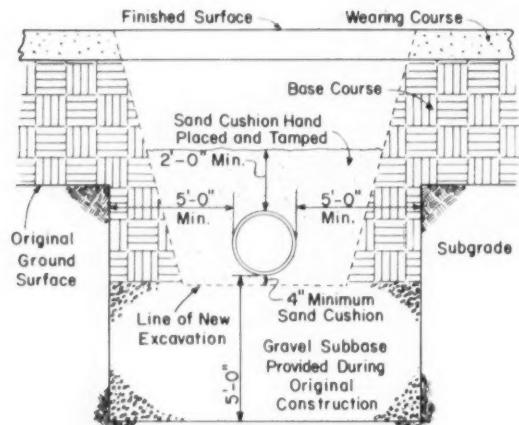
As this equipment is not always available, a substitute spike-tooth harrow can be fabricated in

the field. A satisfactory harrow can be made of three or more wood beams (minimum 6 x 6 inches), or steel beams of convenient length (say 8 to 10 feet) spaced as desired, having rigid spikes protruding $\frac{1}{2}$ inch to 1 inch below the average depth of the loose layer being worked. Spikes should be regularly spaced 10 to 12 inches apart and staggered evenly from beam to beam. As it is desirable to combine the use of spikes and discs, these should be made even though disc harrows are available.

Distribution of the Binder

One of the difficulties of in-place mixing on the runway is securing adequate distribution of the wet, cohesive, lumpy binder material. The tendency is to skimp on mixing when the material is in the final position. Therefore, where cohesive binder is to be added, it is recommended that the materials be premixed thoroughly prior to placing.

This is not too difficult a job. On the processing area, distribute the materials to be mixed, in the desired proportions, and as uniformly as possible. The total thickness of the loose materials as spread is not critical but should not be too great — 12 to 18 inches is a fair estimate. Roll the material with a dozer blade sharply angled and follow the dozer with a disc or spike harrow or both. Continue turning the materials over, following each dozer pass with a harrow pass, and disperse obviously segregated masses of material until a uni-



Culverts require careful design. These are typical sections of culverts for nontundra (left) and tundra areas.

form, intimate, crumbly mixture, free of large lumps of binder, is secured.

After this, spread the mixture to the desired depth (a 3 to 4-inch loose layer is satisfactory for a pneumatic roller) on the strip and compact. Continue spreading and rolling until the desired total compacted thickness (12 inches optimum) is secured. This will provide a good surface course.

Drainage of Airstrips

Few weather observations have been made in the northern areas, and little is known of the amount of precipitation. It is, however, known that there is a low rate of rainfall. Despite this, drainage is a critical item because of the running water's melting effect on the permafrost. The size and extent of drainage required may vary considerably from that of runway projects in a more temperate zone.

The Civil Aeronautics Administration allows a transverse slope of 3 percent on nonpaved runways. With this slope less water will be able to percolate into the strip than is possible if the designer conforms to lesser transverse slopes of other criteria. This results in less softening of the airstrip surface in time of thaw and increases the period that this strip is available for aircraft operation.

If at all possible, drainage structures are to be avoided. But the accumulation of water adjacent to airstrips and taxiways must be prevented, and so drainage is sometimes essential. When this is true, grading is the first solution to be considered. Grading should limit the runoff water retained and divert the flow away from the installation. Cut should not be permitted without special precautions being taken.

Dikes also can be used to divert the flow of water. These are only practicable in areas of favor-

able topography and where construction materials such as gravel and silt or clay are readily available.

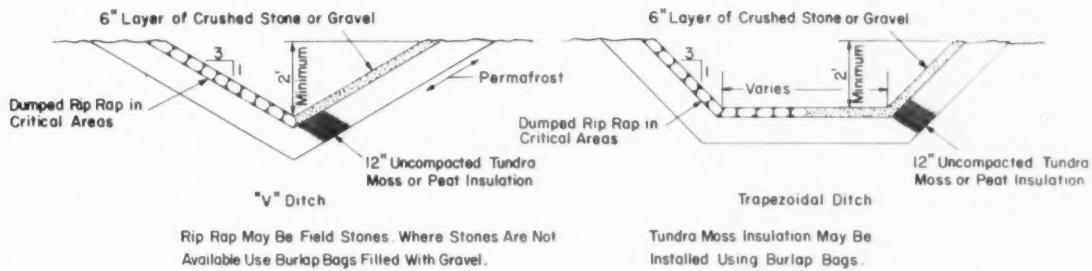
Ditches

Where dikes are not practical, ditches must be used, but degradation of the tundra should be held to a minimum. References are not always clear on this subject. The Navy manual on arctic engineering, for example, suggests that "Deep, narrow channels with relatively small exposure to the atmosphere will be less susceptible to slumping, and their depth will allow free flow of water for a longer period in the late fall than will shallow ones." While this is true, the use of such ditches is feasible only in gravel areas where excessive erosion will not occur, for as S. W. Mueller in his book *Permafrost* suggests, "Wide and shallow drainage ditches are as a rule less susceptible to erosion and slumping." Where deep, narrow ditches are used in non-gravel areas, erosion and slumping must be checked by lining the sides and bottom with tundra moss or similar materials. Where these wide, shallow ditches are used and where preservation of the permafrost is a consideration, the ditches should be constructed at the minimum possible grade.

Locating ditches too close to fills on a side hill slope will tend to seriously destabilize the fill.

Snow Removal

One additional condition is worthy of mention, and that is the effect of snow piled on the shoulders of road and airstrips by snow removal equipment. Keeping the drainage ditches full of snow tends to retard thawing in the early spring. The clear airstrip, however, thaws more readily, but the entrapped water cannot run off. This water tends to boil up through small crevices, and under the



Two types of drainage ditches successfully used in tundra areas. These designs minimize tundra degradation.

pounding action of surface traffic soon develops into almost impassable quagmire.

It will be appreciated that this condition may occur frequently, and the best prevention is to take a small dozer with its blade angled to cut a V-ditch along the approximate ditch centerline and put it in service prior to the thaw. Starting at the downstream end of the trench, the dozer can provide a water course which will be enlarged rapidly by the flow of melt water.

Use of Lampblack

Another method used by the mines around Nome is the spreading of lampblack along the centerline of ditches. Because of a difference in thermo-qualities, the lampblack will absorb heat and melt a small amount of snow in its immediate area. Long hours of daylight tend to speed up this process until a small channel is formed. Flowing melt water does the rest. Other materials possessing differential heat qualities may be used, but the beauty of the lampblack lies in its light weight, which allows it to float in the small pool of water it has formed, thereby continuing its effectiveness.

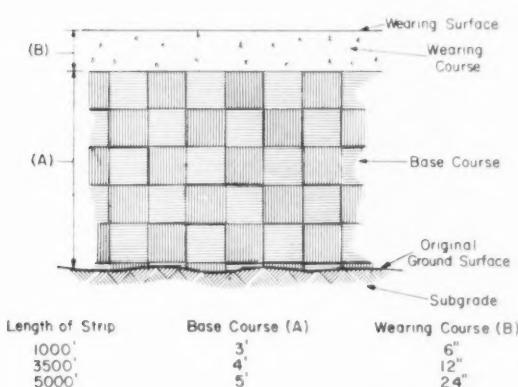
The use of culverts in permafrost is not recommended except where absolutely necessary. Since flowing water will be above freezing temperature, the permafrost may be melted and the result will be uneven settlement with its adverse effect on the surface above. Furthermore, water will tend to flow to the culverts even when they are blocked by snow and ice. This runoff water will accumulate and may result in soft spots on the runway.

Special Approach to Culverts

Where the use of culverts cannot be avoided, special construction methods are required. Excavate the permafrost and backfill with nonfrost-susceptible materials (sand or gravel) to the invert subgrade for a minimum of five feet to each side and below the invert of the culvert pipe. Prior to backfilling, line the cut with an insulating material. Tundra or peat moss taken from some area remote from the site can be used.

Culverts should be provided with headwalls to prevent the washing out of materials under the end of the pipe, and doors should be placed on the culvert ends to keep them free of water when the freeze-up occurs in the fall and to prevent windstorms from blocking culverts with snow. To prevent downstream erosion, flow velocities should be limited. A 0.5-percent slope is recommended.

Grading, ditches, dikes, and culverts are not the answer to every drainage problem in the far north. Each site should be subjected to a detailed study prior to the presentation of any recommendations. Upsetting the hydrological regime can have far-reaching consequences. Some of these will not be immediately apparent and yet actually may result in making the installation completely unusable. For example, any measure permitting subsurface drainage in a permafrost region composed mainly of ice lenses and fine material will cause this ground to become plastic under thawed conditions. This, in turn, would cause roads and airstrips to slump to the level of the existing ground and endanger any existing structures. □



Minimum thickness of runway depends mainly on size of aircraft using it, a function of runway length.

An Engineer Looks Under Iran's Giant Anthills

RICHARD D. HARZA
Harza Engineering Co.



ONE FRIDAY MORNING in late 1955, I was sitting in my office preparing to read the morning mail. Before I could examine the first letter, the mail girl entered my office and placed a single yellow sheet of paper before me. It was a cablegram from Iran. It suggested that I report over to Tehran for "about six weeks" to assist in negotiating an engineering contract for a large dam.

About two and a half weeks and twelve inoculations later, I found myself in a hotel room in Tehran, being briefed by my superior. Within two days, he was on the plane for Chicago, and I was on my own. My job was to fill in the details of a broadly outlined agreement which already existed between our consulting engineering firm and the Plan Organization, an agency of the government of Iran, financed by oil royalties.

At the time, the Plan Organization was expanding its activities following the resumption of oil production after the Mossadeq crisis. To aid their existing staff, they had engaged an American consulting engineer to troubleshoot for them on a number of their projects. This engineer, Walter Binger, of New York, was a man of about 60, thoroughly experienced in the intricacies of engineering services in connection with large civil engineering projects. He and I understood each other quite well, but there were the usual problems of government red tape, translation, government regulations, and special formalities. It took,

in fact, three months to finish my work in Tehran. Even then the actual contract, although in almost final form, had to wait four more months for signature, or seven months instead of six weeks.

In the intervening period, I never was sure the project would go ahead or that our contract ever would be signed. Not infrequently I wondered if I would ever be going home. However, with unaccustomed foresight, I had provided myself with equipment to ease the tensions of the battle. I was able to fill the hours of waiting with the skis and tennis racket, and I purchased a squash racket soon after arrival. The California-like climate of Tehran permits one to play tennis on a December Saturday in town and to go skiing 40 miles out of town on the next day.

I also discovered an old Chicago friend living and working in Tehran. This lucky fellow had managed to find himself an apartment and to open an account with the U.S. Commissary—an excellent source of less exotic food and drink. Before many days had passed, he was even more anxious than I for the contract to be signed so I could return to Chicago!

My own quarters at the hotel were far less enticing. The lobby rapidly became a depressing spot; the food, while attractive at first, did not seem to be designed for my western stomach; and the English conversation was not sparkling.

In this hotel there were about six representatives of American and British firms, all trying to



get agreements signed by the Government of Iran. After several weeks, I began to realize that none of them was getting anywhere. Most had been there for months. Each one seemed to recognize in me (as the youngest and least experienced) a rare opportunity to unburden his story and his theory on how to get the contracts signed. The most remarkable of all these gentlemen was an American locomotive salesman who had worked something over 18 months trying to get an order for his firm. One week before the final decision was to be made, a delegation from another American locomotive firm arrived in town on a round-the-world trip and signed up, on the spot, orders for 26 heavy-duty diesel-electric locomotives! The entire group politely avoided the mention of railroads or related equipment in his presence.

This environment had a useful effect: it forced me to get out and meet people and do things outside the American colony area, which I might not otherwise have done. I was fortunate enough to be taken on a number of field trips, and soon developed an interest in the Persian people, the Persian economy, the countryside, and in particular, from an engineering viewpoint, the anthill-like formations I had first seen from the plane as it crossed Iran. These turned out to be surface manifestations of the world's most remarkable underground irrigation system — the fabulous qanats.

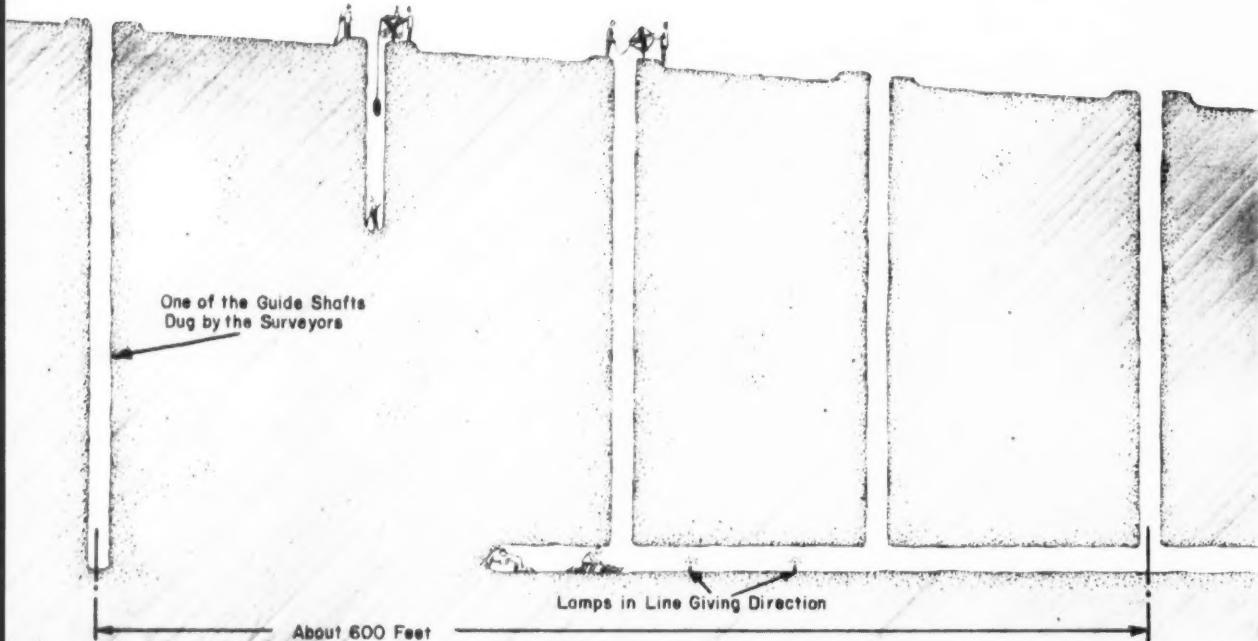
I can recall clearly the day I took my afternoon off to visit the qanats. My guide was a fabu-

lous Englishman who had lived for years in Iran. His father had been general manager of the Iraq Railroad, which had been built by the British in the 20's. He had been raised in Baghdad, educated at Cambridge, fought in the war with the Army of India, walked out of Burma ahead of the Japs, and now was representing a Swedish drill company in Iran. He had an active interest in the agriculture and was quite familiar with the qanats.

History of the Qanats,

The Tehran area is riddled with the qanats, tunnels, and wells, so we had to drive only a few miles out of town to find a construction site. On the way my friend told me about qanats hundreds of years old and still performing their function. Nobody knows when the first one was dug, but the first recorded reference to these underground aqueducts goes back to 209 B.C. Some extend underground for as much as 30 miles. They are characteristically Persian although there are some in the neighboring countries and a few in Morocco.

These qanats are a basic part of the agricultural economy of Iran. When a land owner has enough capital and has decided that he is in a position to take a risk, he may try to dig a qanat to water additional land. His first move is to call in the ancient Persian equivalent of the consulting engineer — the water finding experts. These experienced though somewhat mysterious operators, having once established their fee (it is a



Cutaway of a qanat under construction. The mugannis do their digging with a spade, the excavated material being hoisted in goatskin bags through adit wells. Mugannis guide their tunneling by lining up tallow lamps.

fixed fee whether or not water actually is located), start walking from the land to be irrigated and proceed toward the foothills. As a result of experience, a general knowledge of groundwater conditions, and the ability to make a decision, they eventually indicate a spot on the ground and say, "Dig here." Their services then are completed; they collect their fees and depart. These gentlemen do not carry errors and omissions insurance.

Surveyors and Their Strings

Next, the hopeful land owner calls in the surveyors. These men perform a combined service of surveying, making test pits, and preparing the field layout of the structures. They start by digging a vertical well at the indicated spot. This may go as deep as 300 feet. I have heard of wells up to a thousand feet deep. These wells are dug by hand, the filled goatskin bags being raised on a primitive, wooden, hand and foot operated wheel, which rotates on dry wood bearings turning on dry wood journals. If the diggers hit moisture, they quickly dig six or seven feet farther and allow the hole to fill with water. If the hole does fill to a depth of several yards or more with water, it then becomes the mother well of the proposed qanat.

The surveyors next determine the distance between the ground surface and the water level in the mother well by lowering a string with a rock

tied on the end until the rock touches the standing water at the bottom of the well.

A second string then is used to carry the level of the ground surface at the mother well in the direction of the field to be irrigated (which must be at a lower elevation than the water in the mother well). This second string is folded double and a knot is tied at the mid point. Then one man takes one end of the string, another man takes the other. A third applies a few drops of water toward the middle of the string. The string is stretched almost taut, and when the two ends are at the same elevation, the drops of water collect at the middle of the string, previously marked with the knot. One man, of course, is holding his hand at the level of the mother well. The second surveyor measures the amount the ground elevation has fallen in the length of their first leveling traverse by tying a knot in the first string, the one that was used to determine the depth of the mother well. The process is repeated, moving in the direction of the fields to be watered, until the knots have moved to the end of the elevation string, thus indicating that the ground level has fallen to the level of the water in the mother well. To allow for water flow, a few more stations are measured.

Then the surveyors return to the mother well and pursue a roughly straight line between it and the land to be irrigated. At intervals of about 300

feet they dig marker wells, carefully holding their depths to that indicated by the elevation string. This assures a smoothly flowing qanat system. Their services being completed, the surveyors collect their money and leave.

Construction Methods are Primitive

Now the actual tunneling crew is assembled. These men are called muqannis. They enjoy a unique position in Iranian society, for it is recognized that they are responsible for bringing water to the land, the basis of livelihood of most of the people in the area. Methods of construction seem to be unchanged over the centuries. The muqannis start their digging at the spot indicated by the surveyors to be the lower end of the qanat. They start with a short open excavation and then tunnel toward the first of the marker wells, the digging being done by a young man or a teen-age boy with a spade. The excavated earth, a very loosely cemented gravel, is carried out in a goatskin bag.

About each 100 feet, the muqannis prepare a vertical adit well which shortens the horizontal hauling of muck in the tunnel and permits the tunnels to become self-ventilating. The excavation is done in 4-hour shifts, after which there is a switch with the crew operating the hoist on the surface. Their lighting usually consists of tallow lamps, which also are used for alignment. They set two tallow lamps in the part of the tunnel that already has been dug, then when they look back and see the two tallow lamps lined up, then they know that they are going in the right direction. However, when you walk through a qanat you frequently see sharp bends just ahead of a marker well, which indicates this system is not infallible.

Excavating a hand dug tunnel, up to 30 miles long, in variable soil conditions and with the most primitive of tools and no safety devices is a remarkable feat. Workers suffocate in these qanats; are buried under tunnel collapses; fall down the long wells, and even drown. I do not know what the life span of a muqanni is, but I do know what their pay comes to — about 50 to 70 cents a day. Despite this, they have pride in their work, and there is considerable esprit de corps.

One of the most interesting construction techniques involves the use of "nars." These are oval-shaped sections made at the job site of a burned clay, which gives a consistency similar to brick. They are perhaps 3½-ft. high, 2-ft. wide, and 6-in. long. The walls are about an inch thick.

When the tunneling hits bad ground, which is usually in a wet, sandy pocket, the nar is set up in the last few feet of the self-supporting portion of the tunnel. Nars then act as tunnel supports when back packed with loose material. The long

axis of a nar is placed vertically and the opening provided is large enough for a muqanni to pass through. Because of the oval-shape, the next nar can be passed through the first one, twisted around, and placed up against the first one. It then is back packed. Nars seem so fragile that it would seem impossible to lower them down a well and carry them through the tunnel without breaking them. But it has been done for centuries.

When the qanat nears the mother well digging must be done quickly, for the groundwater table increases the danger. Great care must be taken when holing close to the well because of the gush of water that announces the break-through.

The Completed System

When the water emerges from the other end of the qanat it is welcomed by the excited landlord as a gift from Allah! It appears to be just that, for unlike most irrigation systems, the qanat is mostly hidden from sight. The land traveler sees only a few mounds of earth at the mouth of the wells. From the air you see only rows of gigantic anthills as you fly over Iran. These hills not only minimize the diggers' efforts by depositing the soil as close as possible to the point where it emerges from the ground, it also provides a low dike around the well. Severe spring rains spread sheets of water over the land. If this water were to pour into the wells of the qanat, they would cause a collapse of the whole system.

Sometimes the openings are covered. This occasionally leads to difficulties when an old covered well is forgotten. An American I know returned home one day in his automobile and drove up his driveway only to have it suddenly open up before him. A moment later the shaven, smiling face of a muqanni emerged, his eyes blinking in the noon sun. Within a few minutes the muqanni and my friend were having tea together, the muqanni explaining that he was on a maintenance mission. He had been checking to learn why this particular adit was covered!

During the months I spent in Iran, I became more and more impressed by the qanats and the construction methods used. I could not help comparing the nars with American Marietta's "Inner Circle" method and wondering if this modern company knows it is using a system that is many centuries old — and still works well.

Incidentally, the Karadj Dam contract was finally signed; the construction contractor (Morrison-Knudsen International) is on the job; and construction progress is well along in the second year of the 4-year program. Huge and startling as this project is, I admit to be equally impressed by the qanats and the muqannis who dig them. □ □

Can Consultants Profit From Profit Sharing?



ARTHUR L. SPAET
Partner & Chief Engineer
Slocum & Fuller



Arthur L. Spaet received his Bachelor's Degree in Mechanical Engineering from CCNY. Before the war he had several years of experience in the building trades and then became an officer in the U.S. Army Signal Corps during the war years. Since the war he has had engineering design experience in plumbing, heating, ventilating, air conditioning, and the other mechanical and electrical aspects of engineering design for commercial and industrial applications. He joined Slocum & Fuller in 1949 and is presently a partner and chief engineer. Spaet is a member of ASME, ASHRAE, and AMA, and a registered professional engineer in New York State.

FOR THE EMPLOYEE of a consulting engineer firm, profit sharing can mean better income, greater job satisfaction, and a closer feeling of identification with the firm. The employer can benefit through improved employee morale, increased efficiency, reduce absenteeism, and less turnover. It permits the employer to increase employee benefits without making an inflexible commitment and without an increase in fixed overhead. For both employer and employee, there are intangible advantages such as increased pride in work, more interest in

C_{on}sultant

the future of the firm, and a generally improved sense of security.

But profit sharing can be a disappointment. In some instances it would be better left untried.

Profit sharing has been defined in various ways, and it is necessary to distinguish between plans applicable to the entire staff, and those that include key employees or executive personnel only, which are not here considered to be true profit sharing plans. Bonus and holiday gratuities also are outside the true meaning of profit sharing. One source¹ puts it as follows: "Bonus payments, strictly speaking,

should not be considered profit sharing. They represent paternalistic gifts by the management to the employees. They are not based on a mutual participation plan, but on the grateful appreciation of management for the services rendered by their employees . . ."

In "Profit Sharing Patterns" (1954), published by the Profit Sharing Research Foundation, profit sharing was defined as "any procedure under which an employer pays employees in addition to regular pay, special current or deferred sums based on the prosperity of the business as a whole." Specifically, this would mean a scheme applicable to the consultant's entire staff, under which distribution of funds is according to a previously announced and defined plan.

History of Profit Sharing

The profit sharing concept is surprisingly old. The earliest known examples of modern profit sharing systems were set up in France in a fire insurance company in 1820, and a firm of house painters in 1842. These and other early plans were installed with the hope of winning the cooperation and good will of hostile or antipathetic employees.

Professor E. P. Cheyney expresses some of this in his comments upon 19th century labor-management cooperative movements.²

"In the year 1865, Henry Briggs, Son & Co., operators of collieries in Yorkshire, after long and disasterous conflicts with the Miners' Trade Unions, offered as a measure of conciliation to their employees, or opposition to the trade union, that whenever the net profits of the business should be more than 10 percent of their investment, one half of all such surplus profits should be divided among the workmen in proportion to the wages they had earned in the previous year.

"After a short period of suspicion on the part of the men, and doubt on the part of the employers, both parties seemed to be converted to the advantages of profit sharing. A sanguine report of their experience was made by a member of the firm to the Social Science Association, in 1868, stated that sums between £1000 and £6000 were divided yearly among the employees, while the percentage of profits to owners were as much as 18 percent."

This experiment "split on the rock of dissension in 1875." The scheme was fundamentally wrong in that its basis lay in a conflict rather than in any mutuality of interests.

Nevertheless, a spark had been struck, and widespread interest was aroused on the Continent, particularly in France. In Great Britain, during the period between 1880 and 1910, over 200 plans are known to have started. In the years since then, however, British response to profit sharing has been

less than enthusiastic. Relatively few British companies have adopted profit sharing schemes, and nearly half discontinued their schemes within two or three decades. In all fairness, it should be noted that one of these decades included the depression years of the thirties.

The British case against formal profit sharing was most strongly expressed in the feeling that profits should accrue only to those who undertook the financial risk of a business; if employees were to share in profits in the fat years, they also should carry a share of the burden in lean years. In any event, said the opponents of profit sharing, the economy carries with it an automatic, self-compensating sharing in that employees usually enjoy higher wages in periods of prosperity. British management also pointed out that there is no satisfactory measure of increased employee output, resulting from profit sharing. In fact, there is no certain proof that profit sharing provides any incentive at all.

American profit sharing schemes developed along somewhat different lines; certain aspects of its growth are unique. Profit sharing was known in the United States in the early 19th century, but during this country's formative years profit sharing plans were rare. The economic atmosphere of the early American industrial scene was not conducive to the concept of sharing. The emphasis was on growth and development and the consolidation of economic and frontier gains. By 1900 there were probably less than 100 plans in existence.

During the '20s, there was a small amount of interest in profit sharing as a result, partly, of substantial postwar profits in some industries. However, Krooss³ says in writing of the evolution of trade unionism after World War I, "Welfare plans, embracing improvements in working conditions, insurance, pensions, and recreational activities were extended. High hopes were held for profit sharing and employee stock-ownership plans, but in most cases the results were disappointing."

Through the '30s, the basic problem of most businesses was survival, and there were more losses than profits to share.

In the next decade conditions began to change. Changes in the Federal tax laws enabled employees to obtain benefits under profit sharing arrangements denied them under the wartime wage freeze. Furthermore, contributions by the employer were deductible expenses for tax purposes. Thus, for corporations paying excess profits taxes, only about 15 percent of each dollar spent for profit sharing came out of the company till; the other 85 percent, if undistributed, would have gone for taxes.

This legislation for profit sharing led to an immediate increased interest and to the establishment of a broad base of profit sharing plans, which in

turn led to a considerable amount of publicity. Unions too, for a while, favored this arrangement.

In the '50s, the Federal tax structure of the '40s was a well established fact. The unions themselves were getting into the act, and some of the large industrial giants found themselves under pressure to include profit sharing among the subjects involved in contract negotiations. During these post-war years, sociological and shrewd management motives gave further impetus to the establishment of profit sharing plans in response to the urgent need for finding and holding employees.

Recent experience with profit sharing schemes in the United States seems to indicate that:

¶ Profit sharing works best in stable and well established business, those that are able to make some type of long range economic projection based on past experience.

¶ There is a higher percentage of success in large companies.

¶ There is a higher percentage of success in financial and professional businesses as opposed to manufacturing and mercantile.

¶ There is no difference in success in closely held versus publicly owned businesses.

¶ Success records in unionized companies are good; in nonunionized companies even better.

¶ It is almost axiomatic to state that the best success has taken place in companies with high ratios of profit to payroll.

Surveys show a high percentage of satisfaction with existing profit sharing plans. In 1954, the Profit Sharing Research Foundation, a nonprofit agency, questioned about 300 companies of all types who had instituted profit sharing plans. The results were as follows:

Very Satisfactory	34%
Satisfactory	48%
Neutral & Doubtful	16%
Dissatisfied	2%

Accelerated growth and acceptance of profit sharing plans may be expected. The number of profit sharing plans approved during 1957, for example, came to 2714, a sharp jump of 769 over 1956.

On The Other Hand . . .

Profit sharing is not a panacea. It contains no magic ingredient. There are many things it will not do. In fact, profit sharing can create new problems without solving any that exist.

It can be satisfactorily installed and effectively operated only in a firm that has a satisfactory employer-employee atmosphere. Even in the very best operated and managed firms, there will be an inherent distrust of management's motives in changing the status quo. It has been well established in the literature of industrial psychology that any change

is likely to have the effect of undermining some of the staff's feeling of security. Certain members of the work force respond to a declaration of intent to install profit sharing with the question, "What are they up to now?"

Profit sharing is not a substitute for good management. It does not guarantee a profitable operation. It will not make cost conscious administrators out of every engineer or every technician. Many routine personnel and administrative problems will remain. It also will be found that you cannot buy employees' good will, cooperation, or loyalty with a profit sharing plan. Bye and Hewitt¹ caution the manager-owner by saying: "Supporters of profit sharing believe that it will stimulate the workers efforts and increase his efficiency . . . But it rarely works out that way. The amount of profits earned by an enterprise depends chiefly on factors outside the worker's control, and for which he is in no way responsible. Changes in the demand for the product, mismanagement by top officers, price level and business cycle movements, and similar economic factors are all independent of the efficiency of the individual employee."

If, then, the basic intent of profit sharing is to improve the relations within a firm, the scheme is likely to fail. The authors go on to say, "Broadly speaking, profit sharing has failed as a constructive move toward better industrial relations."

Thus, it can be seen that all of these matters of employee-employer relations must be dealt with, as in the past, with the usual degree of intelligence, integrity, and skill necessary in running a business. In addition, the successful management of profit sharing itself requires careful attention to details, principles, and techniques, as does any other aspect of business management.

Reasons for Discontinuance or Failure

Profit sharing plans do fail. Reasons for discontinuance or failure of plans are various:

Under obvious reasons one might list:

¶ Failure, liquidation, or sale of the business.

¶ No profits or very small profits.

Other not so obvious reasons would include:

¶ The plan may be poorly set up so that there is no correlation between individual effort, individual payments, and company profits.

¶ There may be a high labor turnover, as during wartime or under other unstable conditions.

¶ Deferred payment plans in which, according to the staff, the emphasis is on "deferred."

¶ Stringent government regulation of deferred payment plans.

¶ Either employees or employers or both may feel, after a trial, that somehow conditions are worse rather than better under profit sharing systems.

The rate of discontinuance appears to be much lower with deferred distribution plans than with current distribution plans. Perhaps the reason for this is that deferred distribution plans must be approved by the Internal Revenue Code, and in order to drop a deferred plan, an employer must secure permission from the Bureau — and give good reason.

Certain Special Aspects

It seems clear that something special is necessary in the tone and atmosphere of an office for the successful installation and operation of a profit sharing plan. Just as pretzels go with beer, and specifications go with drawings, so a wholesome employer-employee relationship is necessary for successful profit sharing.

It is almost impossible to institute a good profit sharing plan in a company where there is a lack of mutual confidence and trust between the employee and the employer. The entire concept of profit sharing is so dependent on good faith and on a feeling of respect of one group for the other. Furthermore, there can be no attitude of paternalism or charity on the part of management.

Other essentials are that the company pay fair wages, have some effective technique of salary administration, some kind of rating system, and some method of checking its salary scales against the going rates.

Employees or their representatives on the plan committee should be taken into the confidence of the partners or owners and given full information about the workings and the financial operations of the firm—from top to bottom.

This can be effected by a continuous process of education of the staff in matters of management. Many business matters and the everyday burdens of routine front office procedures — matters which seem obvious to management — may be mysterious and even unknown to members of the staff.

Fringe Benefits

The concept of profit sharing in the United States has undergone a slow transition, from a management controlled scheme designed to win over the support of the work force and to foster industrial peace, to a system of earnings distribution, based, it is felt, on good social and economic thinking. Profit sharing seems to work best in promoting good relationships and job satisfaction where it is not the only employee benefit but rather where it is a part of a comprehensive program. This seems to be borne out by British as well as American opinion.

How far should a consulting engineering firm go in setting up fringe benefits for employees? The answer is not one easily determined. The best reply requires an answer to two more questions. How far

do you want to go? How much do you think your business can afford?

The quantity and extent of fringe benefits must be determined by each owner-manager individually, based on his firm's finances, and on the pressures under which he finds himself. It is difficult to compete, for example, for good men against the huge fringe-benefit conscious corporation if you offer nothing more than a straight salary.

A recent survey shows that the following benefits, in one combination or another, are available to the staffs of member firms of the New York Association of Consulting Engineers:

- ¶ Hospitalization insurance
- ¶ Group insurance
- ¶ Paid vacations and holidays
- ¶ Educational opportunities
- ¶ Paid military service
- ¶ Paid sick leave
- ¶ Pension plans
- ¶ Stock purchase plans (in incorporated firms)
- ¶ Profit sharing plans

Our own firm goes further than the average in providing fringe benefits. With regard to paid sick leave, our Procedure and Policy Manual states that the firm will pay up to three full weeks of salary in any one year in the event of absences due to illness. After three weeks of paid sick leave, further payment will be considered on its merits in each individual case. In several instances, we have paid up to six weeks' sick leave. Many firms surveyed limited themselves to two weeks of paid sick leave.

Our attitude toward time off for personal matters is that our employees are a permanent professional staff and should be dealt with as professionals. A man's life does not begin and end at his job; he has other obligations which must be attended to from time to time during working hours and outside of the firm's offices. Thus, reasonable time off for personal matters may be taken at the option of the individual employee.

We have had no reason to regret this policy. No member of the staff has abused it. On the few occasions where circumstances have required members of our staff to take time off for personal matters, the time has been made up by them.

Our staff understands the need to push in periods of heavy load; they will work under pressure and at top speed for extended periods of time to meet a difficult deadline commitment; we know we can depend on them. Under these circumstances there is no question but that the members of our staff are entitled to every reasonable freedom in their comings and goings.

With regard to educational opportunities, there are three areas in which our staff has received encouragement. At the lower level, for our draftsmen

and junior designers, we have run a company school. Formal lectures were given, on company time, on specific design techniques and technical subjects. The subject matter has been tailored to the needs of the students. We presently are considering continuation of this type of training.

At a higher level, among our senior designers and project engineers, we have resorted to a more individual type of coaching. The partners take time to discuss individual problems with the senior designers and project managers, and from time to time, when it is possible to get a large enough group of the senior personnel together, discussions will be held on some of the less widely understood problems of our operation such as client-consultant relationships, the areas of responsibility of the various members of the senior staff, or the engineering principles involved in some of the lesser known design specialties.

Certain younger members of the staff have wished to continue their formal education at college level. Arrangements have been made to permit them to fit working hours to school schedules. Cost to the firm of our education work has been estimated at approximately \$5000 per year.

Every member of the staff is entitled to two weeks of paid vacation. Three weeks are given after 10 years of service.

Not less than nine paid holidays are observed. There are occasional additional days depending on the calendar.

Hospitalization and other medical and surgical benefits are covered by a voluntary medical benefit plan (Blue Cross and Blue Shield) paid for by participating members, and there is a supplementary medical benefit plan paid for by the firm.

Group insurance, with individual policies varying in amount according to salary, are paid for by Slocum & Fuller.

If a member of our staff is inducted into the military service, it is our policy to pay him approximately 25 percent of base salary while he is in uniform. This has been done for three members of our staff, of whom one is currently in service.

While these benefits must be fitted into sound business policy and must fit the financial condition of the firm, we realize that we are dealing with people — people with families, people with personal problems, people with financial responsibilities of their own. Therefore, we keep in mind that our body of employees are not only instruments of production but human beings. These benefits affect their income, their sense of security, and in some instances, their emotional health. This policy works for us. It may not work for other consulting firms. The extent of benefits as well as the details of your plan must be tailored to your needs, to your

circumstances, and to your philosophy of management. There is no one approach that fits every firm and every personality.

Introduction to Staff

Topping the other fringe benefits is our profit sharing plan. In instituting and operating our plan, we have learned a lot. We know, for example, that the terms of the plan should be as generous as possible; token payments may do more harm than good. Explain to all employees, in full detail, the basis on which payments will be made. If necessary give background financial detail on the firm. Consider the question of administrative detail: who will administer the plan; how will it be administered; who will set policy? After these items have been settled, allow time for the staff to consider the plan and then sell it to them.

It may appear strange, or even come somewhat as a shock to some, that obvious benefits need to be sold. However, any evidence of benevolence or paternalism is most undesirable. Emphasis should be placed on sharing the profits with those who have helped create them, and any concept of "giving" should be soft-pedaled. Make clear exact details of the operation of the plan during lean years as well as good. The participants should be given an opportunity to share in the administration of the plan. Consult with the staff in working up the details. You should not present the package to them as a *fait accompli*. Also, some arrangement should be made for the re-evaluation of the plan and its operation from time to time.

Profit sharing cannot be used as a substitute for a fair salary. If that is the intent of the plan, the staff soon will see through the subterfuge.

There should be some effort made to correlate individual payments with individual effort. If the plan is arranged so that everybody benefits equally, there is bound to be dissatisfaction where management least wants it — among the hard working employees who contribute more than the slower members of the staff.

These plans do not work perfectly the minute they go into operation. There will be bugs to be worked out. The time required for complete acceptance may be two years or more.

Adoption of Plan at Slocum & Fuller

Profit sharing was first discussed in our firm early in 1954, when a preliminary conversation on the topic was held between the partners. In 1956 it was our intention to take the first steps necessary to put it into effect, but other problems of growth intervened. In 1957, at the start of the year, a rough draft of the plan was submitted to our attorney for review. The revised plan then was presented to the

staff for consideration. A committee with representatives from each of four major staff sections was set up, and this committee held several conferences with the partners. Each committee member discussed the plan with the men in his section. Details were filled in, and the plan was revised and again it was submitted to our attorney. It then was returned to the staff through the committee members for final review and was adopted.

The Two Types of Plans

Two basic types of plans, the current and the deferred distribution, are recognized by the tax laws. For the consulting engineer, the current distribu-

tion plan is probably of most interest. Under this scheme payments are made during each fiscal year or shortly thereafter. The employer takes a current tax deduction for the amounts distributed. As far as the employee is concerned, he is taxed on his salary plus any sum received under the plan. The Bureau of Internal Revenue is not too interested in who is covered or in the details of the system. There is considerable latitude for the employer and he may even be somewhat arbitrary from year to year in administering it according to his own feeling about the firm's financial condition.

Deferred schemes are different. The payments must be made to a trust fund or its equivalent. As with the currently distributable plan, the employer takes a tax deduction for his current contributions, but the fund accumulates without tax. The employee pays no tax for money deposited to his credit in the fund until such time as money is actually received by him. If payments are received at a time of reduced earnings, this provides a substantial tax advantage for him. He may receive payments from the profit sharing fund when he retires, upon termination of employment, or in event of disability. When an employee receives his payment from the trust at termination of his services, this may be taxable only at the lower capital gain rates.

The Bureau of Internal Revenue is much interested in the operation of these deferred plans. All deferred plans must be reviewed and approved by the Bureau and they must be satisfied that the plan is truly deferred and of a permanent, not temporary, nature. The plan must be for the exclusive benefit of the employees, permitting no manipulation of the funds for personal use by the employer, and generally must be nondiscriminating with regard to grades and types of employees covered. There must be some predetermined formula for payments to the participants and for determining profits to be shared under the plan.

Any consideration of the tax and legal aspects of a profit sharing plan obviously requires competent counsel from an attorney and an accountant.

Sources of Information

Before starting to work on any profit sharing scheme, a certain amount of research is required, and there is not too much good data available. There are a number of consultants who specialize in setting up plans and trusts of this sort. They usually can be located with the assistance of your banker, your accountant, or the Chamber of Commerce in your local community.

The best single source for general information on profit sharing is the *Revised Profit Sharing Manual*, published by the Council on Profit Sharing Indus-

FORMULA FOR PROFIT DISTRIBUTION TO EMPLOYEES

Slocum & Fuller, Consulting Engineers

Any distribution of profits is to be made in proportion to this point system, modified by a multiplier based on length of service with the firm and a percentage factor based on merit.

Classification

Technical Section

	Points
Section Chief	20
Project Engineer	12-16
Senior Designer	8-12
Designer	6-8
Draftsman	4-6
Junior Draftsman	2-4
Senior Drafting Room Clerk	5-6
Drafting Room Clerk	2-4

Clerical Section

Clerical Section Chief	8-12
Secretary	7-9
Clerical Assistant & Typist	2-6

Length of Service

	Multiplier
Less than one year	0
1 year to 2 years	1.0
2 years to 3 years	1.2
3 years to 4 years	1.5
4 years to 5 years	2.0
5 years to 10 years	3.0
Over 10 years	4.0

Merit factor: An individual employee's total number of points, determined in accordance with the factors above, shall be increased by a merit rating based on efficiency, cooperativeness, and unusual contributions to company operations. This will be a percentage which shall not exceed 20% of the employee's total number of points.

The total number of points earned by all employees shall be divided into the total sum available for distribution, to determine the monetary value of each point. The shares to be received by individual employees shall be determined by multiplying the number of points allocated to each employee by the monetary value of each point.

COMPARISON OF PROFIT DISTRIBUTION

Under a Bonus System

Profits	10,000	20,000	30,000	40,000	50,000	60,000
Bonus	7	5,000	10,000	10,000	10,000	10,000
Net to owners before taxes	10,000	15,000	20,000	30,000	40,000	50,000
Net to each owner before taxes	5,000	7,500	10,000	15,000	20,000	25,000
Tax paid by each owner	800	1,350	1,940	3,320	4,940	6,800
Net to each owner after taxes	4,200	6,150	8,060	11,680	15,060	18,200

Under a Profit Sharing System

Profits	10,000	20,000	30,000	40,000	50,000	60,000
Owners' base salaries	10,000	20,000	24,000	24,000	24,000	24,000
Amount over for profit sharing	0	0	6,000	16,000	26,000	36,000
Profit share to the staff	0	0	3,000	8,000	13,000	18,000
Profit share to each owner	0	0	1,500	4,000	6,500	9,000
Total each owner before taxes	5,000	10,000	13,500	16,000	18,500	21,000
Tax paid by each owner	800	1,940	2,870	3,920	4,770	5,280
Net to each owner after taxes	4,200	8,060	10,630	12,080	13,730	15,720

tries, located in the First National Tower, Akron 8, Ohio. This organization also publishes annual transcripts which give the questions and answers presented at their annual meetings.

Economics

Our plan at Slocum & Fuller is set up so that in periods of increased earnings the payments to the staff will increase. In periods of ordinary or average earnings, the employees will make out about the same as they did under our old Christmas bonus system. The trouble with bonuses is that when earnings are reduced in any year, the owners still feel morally committed to pay the usual bonus and most employees feel they deserve it. However, under profit sharing, if the earnings are poor, there is an understood and established system to reduce the amount distributed. Conversely, if earnings are good, benefits to the staff are substantially increased. In periods of losses, we, like owner-managers of other consulting engineer firms, will have to search our souls and our pocketbooks to arrive at the best course of action.

The establishment of a comparison table is strongly recommended to any owner who is considering profit sharing. The table published here provides an example. It indicates a possible disposition of earnings and profits before and after installation of a profit sharing plan.

This table shows a comparison for a fictitious firm with a staff of 50 and two owner-partners. It is assumed that each taxpayer is married and has a \$1000 tax deduction. A \$12,000 base salary is assumed for each partner-owner. Profits, after all expenses and owners' base salaries have been paid,

are shared, the owners getting half and the staff dividing the other half.

It is obvious that the owners' tax bracket must be considered in setting up the analysis. According to this table, with the present tax structure, the net profits of the firm must equal approximately \$40,000 before the owner-partners can earn \$12,000 after taxes. At this level of earnings, the amount available for distribution to the staff is about the same, approximately \$10,000, whether a bonus or a profit sharing system is used.

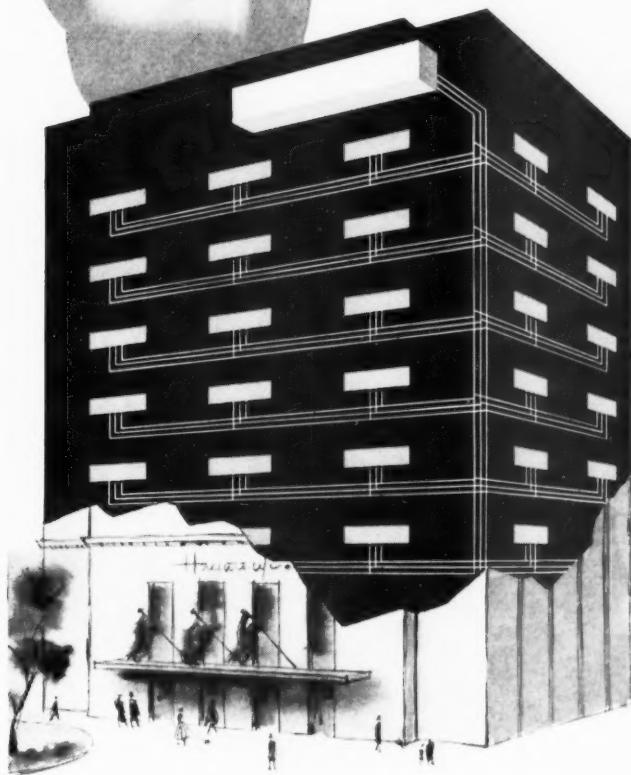
Note that in this example the owners do somewhat better under the base salary-profit sharing plan when the profits are less than \$40,000 but do better under the bonus plan when profits are high. The point at which this change comes about depends primarily on the base salary that has been agreed upon for the owner.

While profit sharing is relatively new in consulting firms, quite a number have had long and successful experience with it, and the number of profit sharing plans in the profession is growing. In our opinion, profit sharing is a trend of our time, fostered partly by changing social and management concepts and partly by our current tax laws. It is consistent with a good over-all working relationship between employer and employee. □

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With the 3-pipe system, units are supplied with hot and cold water simultaneously as required during the year. Room temperatures are regulated by means of non-mixing automatic unit control valves. This completely eliminates summer-winter changeover and nighttime shutdown...offers dramatic savings in power and steam costs.

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Radar Joins the Survey Party

FLOYD W. HOUGH
Geonautics, Inc.



Floyd Woodworth Hough received his Civil Engineering degree from Cornell University in 1919. He joined the U.S. Coast and Geodetic Survey and headed survey parties in this country and Alaska. He then worked on the 240-mile Colorado River Aqueduct in California and was in charge of first-order tunnel alignment. In 1936, Hough went to Pittsburgh with the U.S. Army Corps of Engineers. Following his wartime military service, he became Chief of the Geodetic Div., U.S. Army Map Service. Hough now is a Consulting Geodetic Engineer.

HISTORY RECORDS the art of surveying, or the measurement of lines and directions on the surface of the earth, as one of the oldest professions of man, practiced with considerable skill by the early Egyptians. This is proved by pertinent drawings found in their tombs and by the rather exacting dimensions of the pyramids. As we move through the ages, we find progress in the art roughly paralleling the advance of civilization. The Greek and Roman surveyors became adept

C_E exclusive

at both horizontal and vertical land measurements, despite the strong Greek disparagement of applied science. They perfected a number of instruments including the dioptra, the precursor of our engineer's transit. This instrument, with its plumb bobs, was capable of projecting straight lines, turning off angles, and determining elevations. Leveling was accomplished with the dioptra and two rods, employing the identical principle of differential leveling that we use today.

Activity in the science of geodesy made a great

step forward about 200 B.C. when Eratosthenes, a Greek mathematician of the Alexandrian school, carried out field measurements in the Nile River area and angular measurement of the sun's rays, by which he determined the size of the earth. He came quite close, but he was luckily aided by compensating errors in his measurements.

In 1579, nearly 30 years before Galileo invented the telescope, we find in Denmark an arc of triangulation with two measured bases. The design of this arc easily could be mistaken for some third order control of our day.

Following the advent of the telescope, geodesy and surveying moved forward rapidly to the development of the theodolite, astronomical transit, engineer transit, steel tape, chronometer, spirit level, barometer, plane table, and invar tape. This equipment has made it possible during the past two centuries to establish basic geodetic control systems throughout the more advanced nations.

The introduction of the aerial photogrammetric mapping technique 30 years ago practically replaced the plane table; its application over the past few years, aided by stereo-mapping equipment, has accelerated mapping to a phenomenal degree, not only in the scientifically advanced countries, but in many otherwise inaccessible regions of the earth. Electronic computers have made it possible to adjust survey data and to bring together into a single coordinated system many of the hitherto isolated geodetic datums of the world, the ultimate aim being a common geodetic datum.

Scope of the Sciences

Geodesy is defined as the geophysical science dealing with the study of the figure of the earth, its shape and size, and the variation of the earth's gravity. Geodetic engineering is the application of geodesy and involves the measurement of gravity anomalies as well as the accurate determination of positions of basic control points on the earth, these



Highway Information Services

Tellurometer system has two-way radio telephone for communication between master and remote stations.

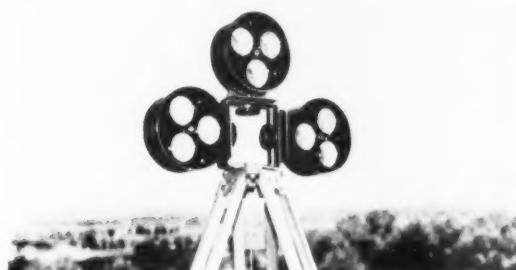
points being so distant one from the other that the effect of the earth's curvature becomes a major item in the calculations.

Surveying is a general term which includes geodetic engineering and all other terrain surveying such as military, cadastral, topographic, hydrographic, and construction surveys. Control surveys, or the establishment of relative locations to provide coordinated positions for military use, for mapping, or for economic development, may be classified by reference to the accuracy achieved: geodetic — that of first or second order; topographic — that of third or fourth order.

There are, it is believed, two events that stand above all others in their effect on the development of the art of surveying. The first was the invention of the telescope by Galileo, in 1609, which resulted in the theodolite and many other lenticular aids to field surveys; the second was World War II, which produced the bombing location techniques, known as SHORAN in this country and its sister development in England, called OBOE. It was, therefore, the wartime need for accuracy in blind bombing that brought surveying into the electronic age.

Electronic Developments

A U.S. Coast and Geodetic Survey officer, temporarily assigned to the Air Force, Carl I. Aslakson, first recognized the surveying potential of Shoran.



Berg, Hedstrom & Co., Inc.

Today's surveyors have a host of precision and time-saving aids. This unit is a trihedral prisms reflector.



Berg, Hedstrom & Co., Inc.

Geodimeter principle is based on phase comparison of frequency modulated light. This is the model 3.



Berg, Hedstrom & Co., Inc.

Geodimeter model 4 is for short range measurement, yields 1st order accuracy in 15-20 minutes' set-up time.

For several years after the war, Aslakson conducted successful experiments to improve its accuracy and to adapt it to geodetic control work. These improvements led to HIRAN (high-precision Shoran), the surveying technique by which geodetic measurements are made electronically over hundreds of miles of water or inaccessible terrain. Contemporary with the development of Hiran were the research and successful application of light waves to distance measurement by Sweden's Bergstrand. This put surveying in the electronic age.

In less than two decades, the various electronic methods for distance measurement developed in this and other countries have grown enormously in number. The majority employ the propagation of electromagnetic waves, while the remainder make use of light waves. The velocity of propagation is considered identical for both light waves and electromagnetic waves, except for slight differential variations due to meteorological conditions, its latest accepted value being $299,792.5 \pm 0.4$ kilometers per second. The methods employing electromagnetic carrier waves or light waves are termed radar measurements. However, the term radar must be qualified as "cooperative" radar, when the impulse is received at the far end of the line and rebroadcast to the initial station rather than reflected. When the wave is reflected rather than broadcast, a proper terminology is "non-cooperative" radar.

Classifications

Electronic surveying equipment can be classed by usable range and frequencies of the carrier waves:

- ¶ Long range, low frequency, non line of sight
- ¶ Intermediate range, high frequency, line of sight
- ¶ Short range, very high frequency, line of sight

In general, the higher the frequency, the more accurately the distance may be determined, the low frequencies being more applicable as navigational aids or hydrographic survey control than as geodetic measurements.

The long range, low frequency, systems do not require line of sight; they are not greatly restricted by intervening mountains or by the earth's curvature. Some examples are: Decca, Raydist, Lorac, Loran, and E.P.I. (electronic position indicator). The first three are phase comparison systems while Loran and E.P.I. measure the elapsed time of pulse transmission. Loran is very long range, as the name implies, and is used exclusively as an aid to navigation at sea, while E.P.I. generally is employed for hydrographic surveys beyond the line of sight. All five of these systems operate on frequencies under 2.5 megacycles.

The intermediate range and high frequency systems of distance measurement in general use are

Shoran and Hiran, both of which are pulse systems used to determine long distances by measuring the transition time taken by a radio wave to travel between an airplane and the antennas at two ground stations. The distance obviously is minimum between the ground stations where computations show that the airplane crosses the line between the stations. The sum of the two distances to the airplane, corrected for meteorological conditions, instrument factors, the height of the aircraft, and the elevation of the ground stations above mean sea level, give the geodetic length of the line between the stations.

Hiran is essentially the same system as Shoran and is coined from the term "high-precision Shoran." It is an improved Shoran, making use of a rigid control of the signal intensity. The higher frequencies used in these intermediate range, line of sight systems are from 230 to 300 megacycles. Since the earth's curvature is a limiting factor, or very nearly so, the maximum measurement possible with an airplane at 35,000 feet is about 500 miles. Shoran systems are used between surface points without the intermediate station in the airplane but with distances limited to the line of sight.

Accuracy of the New Equipment

Distance errors using Shoran and Hiran, based on errors in measuring transition time, are approximately the same amount regardless of the distance. On lines of 100 miles or more in length, Shoran is capable of a good grade of second order accuracy, approaching first order, and Hiran should be consistently a good grade of first order. Shoran has been employed extensively in Canada; a network now covers almost the entire country with lines from 100 to 200 miles in length. Hiran, in recent years, has been used to extend geodetic control over regions impractical for conventional triangulation, including the Mediterranean, the Antilles, and the island stepping stones of the North Atlantic between Norway and Canada.

The two short range, very high frequency systems of distance measurements now employed on geodetic work are the Geodimeter and the Tellurometer. The Geodimeter, designed by Dr. Erik Bergstrand, of Sweden, was put on the market about 1952. It uses a steady beam of ordinary light as the carrier agent on which an electronic shutter, or Kerr cell, imposes a frequency modulation. Variations in intensity of modulated light are projected to a reflector at the distant station, which then returns them to the Geodimeter. Then, a phase comparison is made. The light as carrier agent in the Geodimeter has a distinct advantage over electromagnetic waves, since the route of propagation is limited to the direct path between the two ends

of the line to be measured. Radio waves, on the other hand, are subject to reflections with some resulting deviations. Light has a distinct disadvantage in that the measurements can be made only at night and in suitable weather. Meteorological readings and corrections are required and are included in the measuring times.

Geodimeter Models

The Geodimeter is made in three models, 2A, 3, and 4. Model 2A is the largest and the most accurate electronic distance-measuring equipment in existence. It has a mean error of a single observation of 0.4 inch \pm 1 part per million of the distance. But its weight of 239 pounds, with generator, largely limits it in geodetic work to the measurement of base lines for first order triangulation. It is said to have a maximum range in clear weather of something over 30 miles and a minimum of 50 feet. Setup time is approximately 15 minutes; measuring time is one hour for maximum accuracy, 30 minutes if slight increase in error is tolerated.

Geodimeter model 3 is intermediate in range. It has a mean error for a single observation of 4 inches \pm 2 parts per million of the distance. Its weight is 58 pounds, and it uses a small generator or 6-12-24 volt battery inverter. The maximum range is greater than 20 miles, with a minimum of 40 feet. Setup time is about 5 minutes; measuring time is 45 minutes for the stated mean error, but this can be reduced by 50 percent with a small increase in error.

Geodimeter model 4 is a relatively new item (1958) designed for short distances of 50 feet to a maximum of 3 to 5 miles. The power source is a small generator or a 6-12-24 battery inverter. The average error is 0.5 inch \pm 5 parts per million of the distance. The weight of the model 4 Geodimeter and its head is 45 pounds. Setup time is less than 5 minutes; measuring time is 15-20 minutes for highest accuracy and 10 minutes or less for third order accuracy.

Tellurometer

The Tellurometer system was designed and is manufactured in the Union of South Africa. It was first marketed early in 1957. This electronic system of distance measurement is unique in that it uses very high frequency radio microwaves of 4-in. wave length (3000 megacycles per second). This continuous carrier wave is modulated by four measuring frequencies of about 10 megacycles. The modulated waves travel from the master unit to the remote unit setup at the far end of the line to be measured. Waves are picked up by the remote unit and rebroadcast back to the master unit, where a phase comparison with the transmitted wave is

made. The crystal-controlled transmission time is read on the oscilloscope scale to 1/3 or $\frac{1}{2}$ of a millimicrosecond, representing very close to 2 or 3 inches on the slope distance between the ends of the line. Several slight variations are used in the carrier frequency to nullify the effect of random ground reflections always present to some degree with electromagnetic waves.

Since the Tellurometer system uses radio waves, operations may be carried on without loss of accuracy in daylight as well as at night — and under inclement weather conditions such as fog, rain, or snow. Line of sight but not visibility is required. Its accuracy is about 2 inches \pm 3 parts per million of the distance involved. The 2 inches may be appreciably reduced by field calibration. Distances from a few hundred feet to 40 miles have been measured regularly, and considerably longer distance measurements have been reported from abroad. Setup time is about 5 minutes; measuring time, including final computations, is 10-15 minutes for second order results and 20-25 minutes for first order. Meteorological readings and corrections are necessary above third order and are included in the estimated measuring time.

The Tellurometer has an efficient two-way radio telephone which provides telephone communication between the master operator and the remote station. A six-volt automobile battery furnishes the power supply. The equipment is rugged and easily portable; the total weight of the various items, including the heaviest, the battery, is 90 pounds.

Tellurometer equipment has come into general use in the United States among private surveying and mapping organizations as well as the Federal and state agencies. It is used extensively in the Interstate Highway Program for traverse, trilateration, and picture point location, with costs estimated at 60 percent of those for conventional triangulation and traverse.

Of these several methods of electronic surveying, certainly the Geodimeter models 3 and 4 and the Tellurometer are the two of greatest interest to the average civil engineer for they are designed to measure with geodetic accuracy relatively short distances from a few tape lengths up to 30 or 40 miles. These are, however, distance-measuring instruments exclusively. Neither measures horizontal or vertical angles; this must be done by the transit or theodolite as in conventional methods of triangulation or traverse.

Manifold Advantages

A general trend toward higher accuracy as well as efficiency in field survey operations has been the logical result of the development of better conventional survey equipment. The advent of elec-

tronic distance measuring devices now permits a party to do eight or ten times the amount of traverse per day that was possible when there was no alternative to the drudgery of ground taping through rough and bushy terrain, and considerably greater accuracy is achieved. Base lines in triangulation are readily obtained by measuring electronically occasional sides of the triangulation rather than by staking and taping shorter lines of base nets. Similarly, measured sides as additional bases can be inserted into existing triangulation arcs, thus permitting increased over-all accuracy in the readjustment of the triangulation.

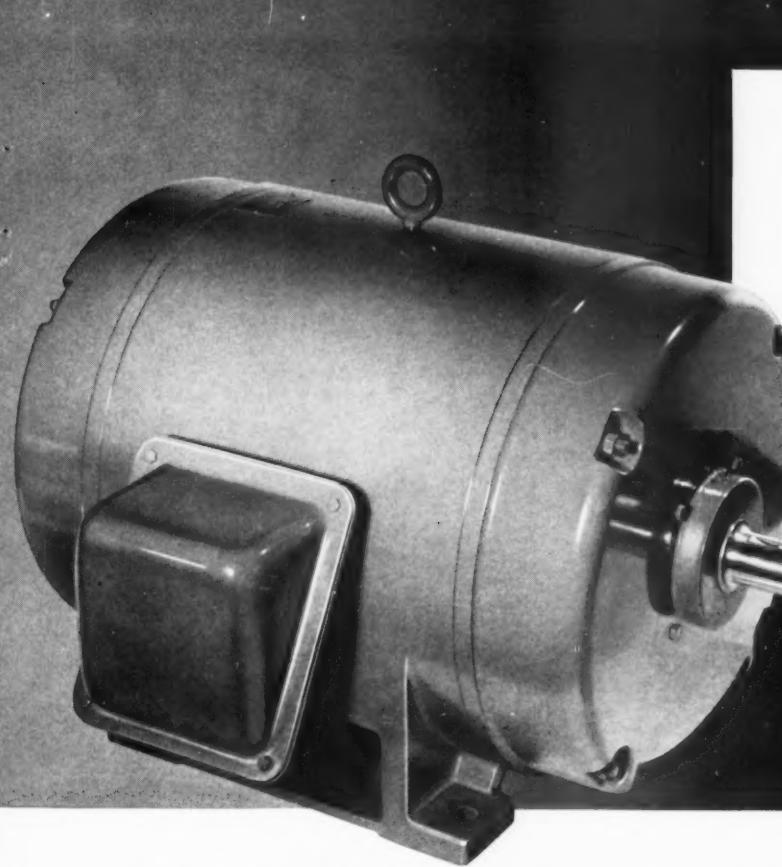
In forested and jungle areas, trilateration networks of geodetic accuracy can be established by measurement of all the sides of the figures rather than the angles. This means the stability is no longer critical and the Tellurometer instrument can be set on the sawed-off trunk at the top of a tall tree. A platform can be built for the observer and the independent scaffold required for a theodolite is avoided. A minimum of clearing need be done, since the radio microwaves normally will pass through any scattered timber tops on line.

Vertical Positioning

Vertical positioning can be achieved by electronic methods but by no means, as yet, with the accuracy and reliability of horizontal location. Narrow beam radio altimeters, which give the elevation by radar of aircraft above the ground surface, have been developed. These will furnish a profile of the ground within 10 to 30 feet under ideal conditions. These ideal conditions of terrain involve areas where the height of the airplane can be determined by frequent calibration over lakes or relatively flat regions of previously known elevation. But much remains to be done in the development of adequate profile recorders. When perfected, mapping by electronics will have passed another milestone in its rapid evolution.

Undoubtedly, we are on the threshold of further advances in electronic surveying. Details of rumored developments are not sufficiently reliable to warrant discussion or detailed predictions at this time. Certainly, when reliable transistors become available for use on very high frequencies, improvements will follow, particularly with regard to size and weight of equipment.

The evolution of surveying into the electronic age has been greatly enhanced by military requirements in the rocket and missile age, and the designers of survey instruments are contributing much to our national defense. We may feel confident that they will continue their outstanding progress. The geodetic engineer and surveyor must keep abreast of these developments. ▲▲



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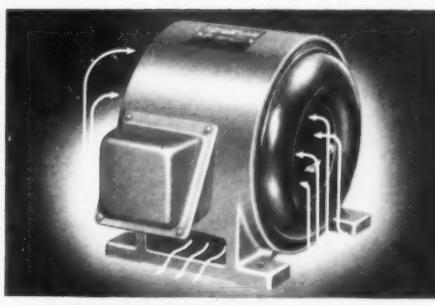
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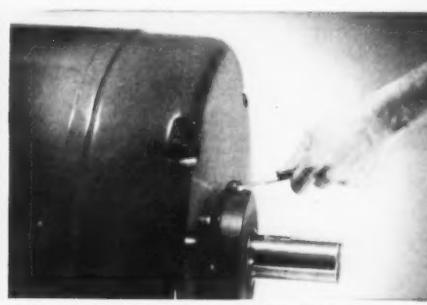
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Private Practice Has its Problems

... even in Japan

STUART GRIFFIN

PROFESSIONAL consulting engineering is a new concept in Japan. Traditionally consulting engineering has been done by low salaried university professors for the extra income. These side jobs often pay the consulting professors a better hourly rate than their regular teaching jobs. The bulk of this work is in the hands of name professors from Keio, Waseda, Tokyo, Tohoku, and Kyushu universities, private and state-supported institutions with engineering departments. Acknowledged leader is Tokyo Technical University, with a whole department given over to design, development, and construction consulting.

Foreign Firms

Outside of the work done by professors, consulting engineering in Japan is chiefly in the hands of foreign firms. From the Japanese viewpoint this is another activity monopolized by foreigners. But the Japanese forget that their experience in private practice is at least 30 years behind the U. S. and Western Europe.

The 30 or 40 foreign engineering firms—primarily American, British, and German, with a few Swedish, French, Swiss, and Italian—deal with

their Japanese clients through a network of tie-in agreements. Some of these firms are competent, well-established companies trained for a multiplicity of engineering jobs; others are borderline concerns seeking (in the wake of the American occupation) vast profit opportunities for marginal engineering services.

Best-known foreign firms are MacPhee Industrial Engineering (American), U. S. Consultants (American), Far East Superintendents (Swiss), and International Standards & Testing (American).

The MacPhee firm is a good example of a competent and successful firm working in Japan. Staffed with seven American engineers and 35 Japanese engineers and former technical college professors, it acts as consultants for both Japanese and foreign firms, inspects and tests products, advises on a wide variety of industrial problems, and helps Japanese manufacturers develop new products to meet U. S. and world standards.

Top-ranking Japanese consulting firm is the Tokyo Industrial Corporation, which maintains a staff of 50 Japanese engineers and a number of British, American, and German advisors. It is working mostly on hydroelectric plants, jet engines, plastics, and electronic equipment. Most



other Japanese firms in the consulting engineering field are in the novice class.

Fee "Schedules"

Fees are whatever the traffic will bear. They range, by American fee standards, from the absurdly low to the ridiculously high. And since there is no engineering association, little has been done to establish a uniform schedule of fees or even ethical codes. Legitimate consulting firms consequently find it hard to fight the cutthroat price competition offered by the small, vaguely legitimate concerns.

Marked differences exist between the costs of services and the quality of services actually performed. There is little original design work done and little true consulting services offered. Imitation is still the rule in Japan.

When they exist at all, professional ethics are low. Trade secrets of one client often are sold outright to another in contract bidding. Connivance takes place. Specifications for equipment and materials of construction are made with an eye toward personal enrichment. There is no monitoring by any organization to ensure codification of ethical standards or their follow-up.

As yet there is no very close relationship between consulting engineers, architects, contractors, or engineers in government or industry. However, an association of Japanese engineers, now in the formative stages, will have a branch dealing strictly with consulting services. Another, the JIS (Japan Industrial Standards Association) also shows promise, but unfortunately neither group has made much progress to date.

Many major Japanese firms—Hitachi, Tokyo-Shibaura Electric, Mitsubishi Shipbuilding, Toyo Spinning, Yawata Iron & Steel, Fuji Iron & Steel, Uraga Dockyards, Yashica Camera, Daiichi Bussan—keep well-paid foreign engineering advisors on their staffs. Some of these foreign technical advisors were hired in prewar days, others have been engaged in the post-war rebuilding period.

These foreign engineers have high prestige, earn good salaries, receive special consideration in

stock shares, company houses, and golf club memberships, and are allowed special tax exemptions. Up to 1954, 50 percent of income earned in Japan by a foreigner was not subject to taxation and no foreigner need declare what he earned outside the country. The special tax basis continues in that these technical consultants now pay only 70 percent of what Japanese pay, and will not pay the full 100 percent until 1960.

This system of foreign experts on Japanese payrolls is kept quiet, since hostility toward the system already has erupted in the Japanese press. A series of articles has denounced these foreign engineers, stating that they are "milking the country" and doing local people out of jobs. Though sensationalized, the criticism is trenchant, for the big engineering jobs do go to foreigners; only small jobs remain in Japanese hands. This will continue until the Japanese develop better consulting services of their own.

"Feudal Concept"

"Japan is plagued," said one American consultant, "with a feudal concept that 'nobody outside the company should know anything about what is going on inside the company.' Japanese just cannot imagine bringing an outside consulting engineer, not even another Japanese—let alone a foreigner—into their business."

A Swiss consulting engineer nodded agreement. "Except in a few, a very few, highly specialized fields, the concept of a consulting engineer is unknown. Japanese business practices are traditionally secret, firms acting like families in that they are close knit and present a united front to the world. All too often they are suspicious and hostile of outside interest in their private doings."

If a man is brought in from the outside, reason the Japanese, he can study the internal processes of a firm and learn the innermost secrets of its production. He is then in a position to sell his knowledge to a competing firm.

Japanese business works in vast mazes of contracting and subcontracting so that in the coun-

The Rabbit Who Had Only One Ear



Once upon a time ...

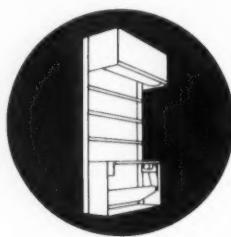
there was a rabbit who had a reputation as a very dumb bunny... He listened to only one side of the story. He hadn't heard that Automatic Roll-Kleen Air Filters, handling millions of cfm, made by Farr Company were being installed all across the land.

One day his friendly Far-Air man pointed out the Roll-Kleen features. When he saw the 24-carrot quality of this filter, his good ear stood straight up... (for quality is hard to hear even with two ears).

Now Mr. Bunny's clients multiply, for only maintenance-free Roll-Kleen will he specify.

Moral:

Compare before you specify. Hear all sides of the Automatic Filter Story. Nibble off the coupon below and mail it today.



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COMPANY

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FARR COMPANY
P.O. BOX 45187 AIRPORT STATION
LOS ANGELES 45, CALIFORNIA

Hop to it and send me the new Roll-Kleen Bulletin B-1400-2A today.

NAME _____

TITLE _____

COMPANY.
STREET
ADDRESS

CITY & STATE _____

try's strictly controlled economy there is, as one man phrased it, "a little something for everybody . . . a little of everything to go around, to get by with."

Construction practices would stun an American consulting engineer. Instead of using a crane to lift large beams, for example, a swarm of laborers carry the beams up a labyrinth of bamboo scaffolding. Excavation for a new building is done by a small army carrying dirt-filled baskets.

Men Instead of Machines

One reason for using men rather than machines is to spread the work around. A machine might replace 100 men, but then what would the 100 men do? From a coldly economic viewpoint the machine might be more efficient, but from a political viewpoint the machine could not be used. An American firm of consulting engineers found this out when they set up an elaborate telemetering system to read remote gages in a hydroelectric plant. Japanese company officials were apologetic but they could not use the system. Instead men were hired to read the gages at the various locations.

Another reason for using men instead of machines is the high cost of equipment. In a country where a new Cadillac brings \$15,000, it is much cheaper to hire help than to buy a bulldozer. Even in Tokyo, notorious for its high cost of living, a laborer earns only \$1 a day. Outside Tokyo the wage scale drops rapidly.

But the few foreign consultant engineers are teaching the Japanese better methods of production, cost and quality control, factory and plant management, site selection, specifying and purchasing materials of construction, and the need for standards, ethics, and means of enforcing them.

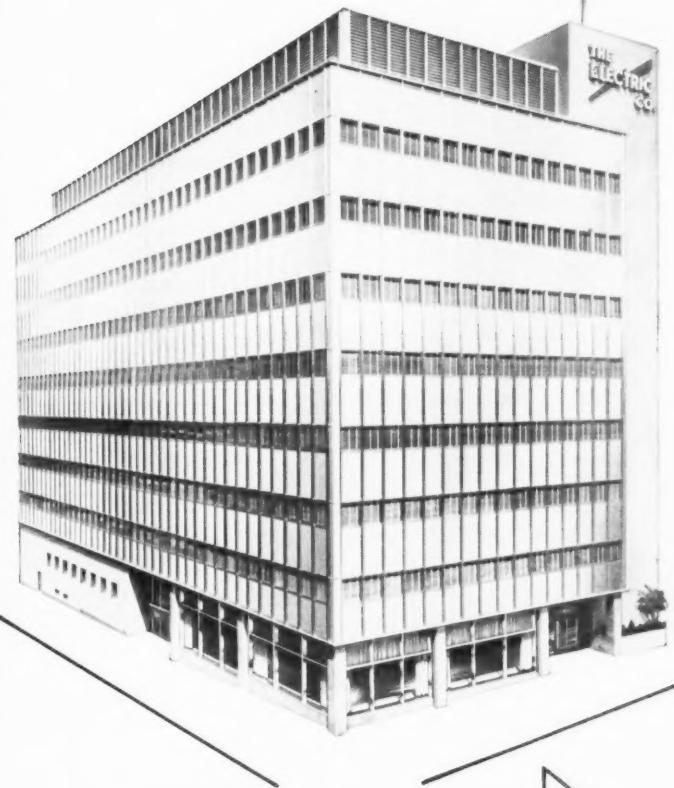
Requests for consulting engineering services are still mostly from the government, especially since much of the work is done under the postwar reparations programs with the Philippines, Burma, the three states of what was once Indo-China, Indonesia, and others. Other bids are quasi-governmental, involving work in Korea, Formosa, Ceylon, India, Pakistan, Thailand, and Malaya.

The United States military, especially the air force, has helped spur Japanese consulting engineering. While very little engineering has been done by prefectural governments and only a fair amount by MITI (Ministry of International Trade and Industry), much is being done by the USAF qualifications division.

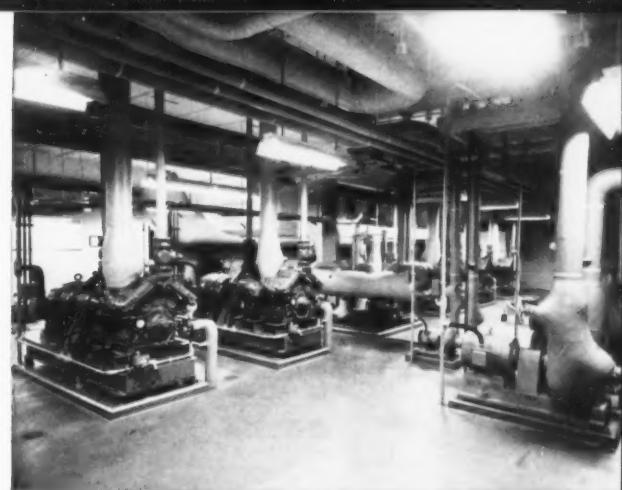
Since a large part of this contractual work—worth many millions of U.S. dollars—is in foreign consultants' hands, the Japanese are learning fast, because they must, about the necessity for the services consultants can offer. □

cold weather air heats new 9 story building

World's largest electric air source
heat pump installation uses
12 Weinman pumps



NEW Columbus and Southern Ohio Electric Co. building, Columbus, Ohio has 9 stories above ground, one floor below ground level. It is designed for ultimate occupancy by 1,000 persons.



MAIN BATTERY. The main heat pump for the Columbus and Southern Ohio Electric Co. consists of 2 separate systems, each having three 100 hp. compressors (a total of 6). Right foreground: Weinman pumps in water distribution system are insulated to keep condensate off floor.

The world's largest electrically powered air source heat pump air-conditioning this new building with 171,200 sq. ft. of floor space. The heat pump supplies 3.5 million BTU per hour for winter heating and 700 tons of refrigeration for summer cooling. This is the first application of a heat pump with a high-velocity induction system. The primary air system supplies high-velocity air to 537 underwindow water coil units around the building perimeter. These induction units are supplied 52°F. water the year 'round. Water temperature for the air-handling system serving the interior core of the structure is maintained at 42°F.

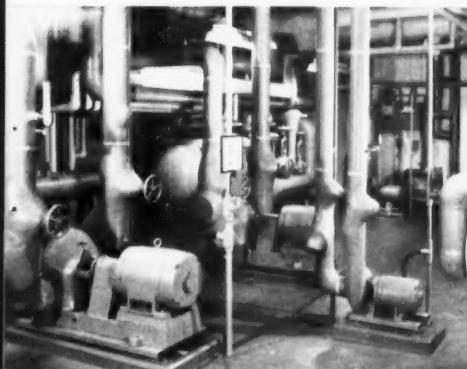
Weinman pumps used exclusively

12 Weinman pumps handle all liquids circulated in this big system. This includes hot and chilled water distributed to the air-handling system and hot water supplied to coils which reheat filtered air. In addition, heated oil is piped under the sidewalks to melt snow and ice.

Only Weinman pumps are used in this big installation. No other make. There's a good reason. Weinman's complete line guarantees the right type, size and capacity pump for every need. And Weinman quality assures top efficiency, dependability and operating economy. Whatever your pumping problem, it will pay you to call your Weinman representative (he's in the Yellow Pages) or write us direct.

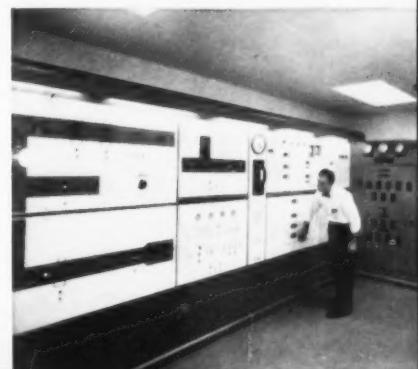
WEINMAN PUMP
290 SPRUCE STREET
CENTRIFUGAL SPECIALISTS

MFG. CO.



NEAT ARRANGEMENT. Weinman Type L-1 pumps, at left, move hot and chilled water through air-handling distribution system. Smaller Type K Unipump (right foreground) pumps cooling water only to IBM room. Because of heat produced by this equipment, room must be cooled all 12 months of the year. Note: Plaque which describes color code used in the power room.

NERVE CENTER. Supervisory data center monitors and controls the entire air-conditioning system. Here, engineer senses return water temperature at one of 75 test points.





Approaches to the Baltimore Harbor Tunnel include a total of 845 four-lamp, six-ft fluorescent luminaires.

Bypass Lighting is Different



Ernest F. Siegel graduated from the University of Cincinnati with the degree of Bachelor of Science in Mechanical Engineering and later took advanced courses in electrical engineering at Johns Hopkins University.

Before joining Green Associates, Inc. six years ago he had been employed by Polarmold Research Laboratories, The Kuempel Engineering Company, and Blaw Knox Company. Siegel now holds the title of Chief, Mechanical-Electrical Engineer. He is a registered professional engineer in Ohio, Pennsylvania, Maryland, and Florida, and is a member of IES, ASHRAE, and Baltimore Nucleonics Society.

THE URBAN BYPASS has become a popular means for diverting through traffic around major cities, as well as a fast route in and out for commuters. Bypasses, in general, are controlled access, high-speed roads and in their construction differ very little from intercity expressways. The lighting

CE exclusive

ERNEST F. SIEGEL

Chief, Mechanical-Electrical Engineer
Green Associates, Inc.

engineer, however, is faced with an entirely different problem from that he would encounter in lighting either a city street or an interstate highway.

New Design Concept

Since the urban bypass is a relatively new concept in highway design, it follows that lighting a bypass involves new problems. In the past only a limited amount of thought has been given to the special problems that arise in the design of a bypass lighting system. A few bypasses were lighted using methods similar to those used for cross country highway lighting. These methods have subsequently been found to be less than adequate. In order to produce a good installation, all the factors peculiar to urban bypasses must be considered.

In view of the Federal highway program, urban bypass lighting is anything but a theoretical problem. The program includes a large number of urban bypasses to connect the interstate road system.

Therefore, many consulting engineers and state road commission design departments will be faced with the design of adequate, economical lighting systems.

Special Considerations

A bypass highway threading through the outskirts and sometimes peripheral residential sections of the city is exposed to considerable background lighting. Residences, service stations, restaurants, advertising signs, and perhaps parallel city street lighting combine to provide a substantial and varying background.

Background lighting is not a particularly serious problem when the driver is moving on a familiar route within the city at speeds ranging from 20 to 40 mph. When the driver enters a strange highway at night, traveling at 50 to 60 mph, and is suddenly surrounded by high or medium intensity outdoor lighting from a variety of sources, his roadway visibility decreases for several reasons. His eyes cannot always adjust to the differential in lighting intensity between the background and the unlighted road. Unless the highway on which he travels is well lighted, the variations in background illumination will provide focal points, diverting his eyes and mind from the road. This often is the cause of accidents.

The number of interchanges or exits on a bypass is far greater per mile than would be encountered on intercity highways. This greater number of exits and entrances represents a hazard, for traffic must merge or divide at these points. Unless sufficient lighting is provided, some drivers will find themselves leaving a bypass in the wrong direction or at the wrong exit.

We find also a mixing of drivers accustomed to high-speed driving on the open highway with city drivers who have just entered from low-speed city streets. This is a particular hazard in the dark, and it accentuates the need for good lighting.

Need for Lighting

The need for highway lighting has been discussed in many articles and the advantages have been well documented. Night accidents have been reduced by over 40 percent in Connecticut cities, and by a similar percentage in Ohio and Indiana when various roadways were provided with lighting.

No one can express the value of human lives in dollars, but there is little doubt that the saving in property damage alone will more than pay for a lighting installation as well as its maintenance and upkeep. Our studies show that the installed cost of bypass or general highway lighting rarely amounts to one percent of the total construction costs of the project. This is indeed a small price to pay for an installation that promises so much.



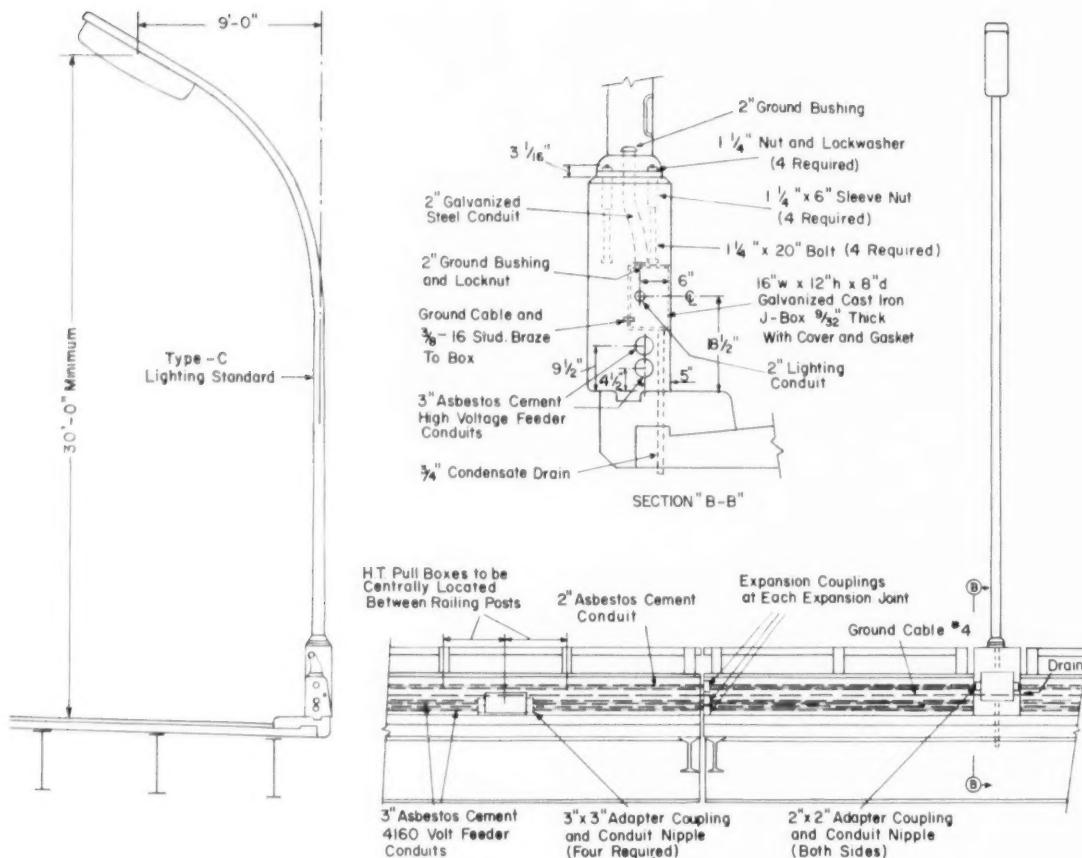
Fluorescent luminaires were specified because of their absence of glare, instant starting, and long lamp life.

One important aspect of bypass lighting is its aid to the out-of-town driver, permitting him to see his way through the maze of interchanges he will encounter, and helping him get off the highway at the desired point. It appears that even though the size of lighted direction signs is being increased on all highways, many people pass exits before they realize it. Getting back is quite a job. When the arrangement of highway lighting standards acts as an additional guide, this problem is all but eliminated. A driver may miss an unlighted road, but it is hard to overlook a string of lights leaving the highway at an exit point.

In the construction of an urban bypass, the erection of overpasses and underpasses must be built to cross existing city streets. The consulting engi-



View of north approach to tunnel near U. S. 40 shows the typical distracting background lighting of a city.



Details show the careful design of the steel tube lighting standards and the power distribution system.

neer must remember that where the new highway passes over an existing street, he creates a dark area. Unless adequate lighting is provided, a serious traffic hazard will be created on a city street.

Design Elements

The design of urban bypass lighting must include provisions for:

- ¶ Good visibility to reduce accidents.
- ¶ Sufficient lighting to offset the effects of background illumination.
- ¶ Accentuating points of entrance and exit to the highway as well as other areas, such as toll booths, where traffic must slow down.

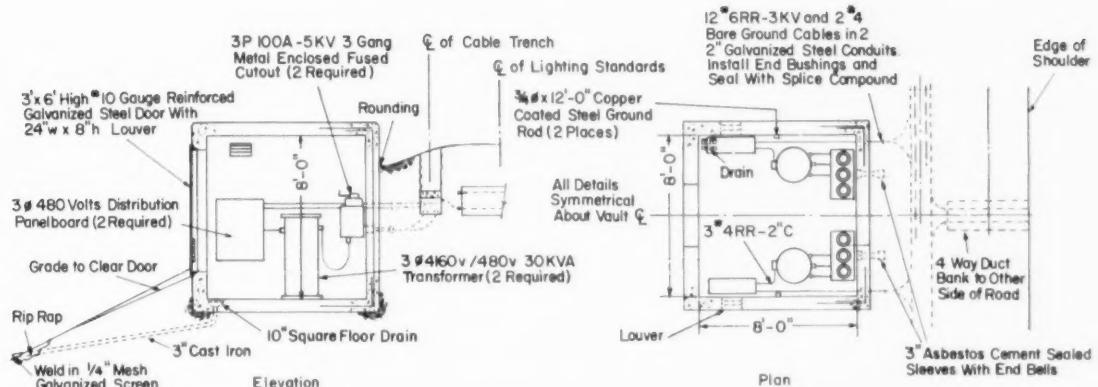
Good visibility or discernibility is a direct function of the amount of illumination provided on the road surface and on moving vehicles. It is an inverse function of the amount of glare produced by the luminaire. Where background lighting is intense, the intensity of illumination must be increased to accentuate the limits of the roadway and provide object discernibility. At points of exit or

entrance, the layout of lighting standards must be arranged so that they act as a continuous guide-strip to the motorist.

Baltimore Harbor Tunnel

The Baltimore Harbor Tunnel project is a typical urban bypass. Before this roadway was built, Baltimore was the biggest traffic bottleneck on the East Coast. It took the motorist coming from Washington and heading for Philadelphia 55 minutes or more to pass through town. With the new bypass this time has been reduced to under 12 minutes. Seventeen miles of roadway, 12 interchanges, a 1.7-mile long tunnel, and 53 bridges make up this \$130 million project. Roadway lighting represents an important facet of the design.

The out-of-town motorist was forced to battle narrow streets, traffic congestion, stop lights, streetcars, and local traffic, and to slow down from his normal highway speed of 50 to 60 mph to less than 25 mph in many areas. This resulted in further traffic congestion on city streets, increased accident



Transformer vaults are one mile apart alongside the highway, step down power supply from 4160 to 480 volts. Vaults have cutout switches and fused branch circuit cutouts to allow isolation of any secondary circuit.

rates, and caused general annoyance to out-of-town drivers as well as the local population.

Approach and Tunnel Lighting

The approaches to the Baltimore Harbor Tunnel make use of 845 four-lamp, six-ft, fluorescent luminaires. Operating at full capacity, the lighting system provides a maintained illumination level of 0.6 footcandle. The tunnel itself is lighted by continuous strips of fluorescent tubes mounted on each wall. These tubes are controlled from saturable reactors so that the output intensity can be varied. Obviously the lighting problems inside the tunnel are different from those encountered on the open approachways. While no lighting is required during the day on the approachways, the tunnel lighting system must operate at its highest intensity during the day. At night, roadway lights are switched on while tunnel lighting is reduced to its lowest level.

Power Distribution

An economic study of power supply and rates of power revealed that it would be advantageous to feed the roadway lighting from the two ventilation buildings located at either end of the tunnel, since a large amount of power is required for the operation of the ventilation equipment. This scheme permitted primary metering and operation at low power rates. The power to the ventilation buildings is brought in from four separate feeder loops, thus assuring reliability of service. In addition, feeding the lighting from the ventilation buildings permits control of the entire project from two points.

On an urban bypass which does not include a tunnel, it probably would be advantageous to feed the roadway lighting system from strategically located supply sources furnished by the utility company. These supply sources should be no more than

two miles apart so that the high supply voltage can be reduced at each location and fed in both directions. While a multiple system of power distribution was desirable for the Baltimore project, other installations might find a series system more advantageous. Where power cannot be made available by the power company at two-mile intervals, high voltage must be distributed from the nearest source along the highway and transformed to the desired low voltage every two miles.

Running high voltage power lines along the highway may set up a number of problems. Overhead distribution is unsightly and subject to outages, while underground distribution is costly. Thus, all factors affecting the power supply system for a particular project must be analyzed carefully before a decision is made. An elaborate system of grounding is essential, and the installation work must be carefully supervised to assure low ground resistance after the system is completed.

Selecting Luminaires

Considerable study was given to the selection of luminaires and standards for the Baltimore project. After analysis of all types of roadway lighting equipment and an examination of the results obtained on other high-speed roads, it was decided to use fluorescent luminaires. Fluorescent units have the advantage of low brightness, absence of glare, immediate starting, long lamp life, and low lamp replacement costs. Furthermore, four-tube luminaires make it possible to feed two tubes in each luminaire from a separate circuit. This assures continuity of roadway lighting even if one circuit fails. It also permits operations at 50 percent of capacity during periods of low traffic count.

While fluorescent units were considered most desirable for this project, mercury vapor equipment

should by no means be rejected as a possibility for other installations. Mercury vapor units are initially less expensive than fluorescent luminaires, and they can be mounted on smaller diameter poles, since they weigh less and offer less resistance to the wind. Their greatest disadvantage is glare and starting problems. It is well known that the fluorescent unit will produce light as soon as a switch is turned, and then will relight instantly upon restoration of power following a power failure. However, mercury vapor units need a warm-up period, as much as 10 minutes after a power interruption.

Special Luminaire Design

An effort was made to design a luminaire which would closely approximate commercial units available and yet would eliminate certain disadvantages. Our final design provided a luminaire which can be relamped in place with very little effort. It is adjustable in both the vertical mounting plane and, by rotation, about its central axis. It can be mounted on davit type poles without visible hardware and can withstand 110-mph winds.

Another feature is that a polyurethane foam gasket was developed to seal the luminaires against the entrance of moisture or insects. This gasket material remains resilient after prolonged use, and it is not affected by elevated temperatures such as are encountered in these luminaires. This material is rapidly being accepted as a gasket for all types of enclosures designed for outdoor service.

Designing the Standards

Great care was given the design of the lighting standards. From the outset a clean tapered davit type pole appeared desirable to keep the lighting installation in harmony with the modern appearance of this roadway. The standards are tapered steel tubes, davit type, with a curved section having a 12-ft radius and a mounting tenon attached tangentially at the end of this section. Luminaires are mounted at an angle of 25 degrees with the horizontal to assure the maximum efficiency in over-all light distribution.

Power emanating from the ventilation buildings is distributed on the project at 4160 volts, 3 phase, using No. 4 direct buried cable in trenches parallel to the roadways. Where cables cross the road or are installed in structures, they are encased in asbestos cement conduits. On all 53 bridges on this project, the operational, as well as spare conduits, are carried in the parapet walls with pull and connection boxes installed in the parapets.

Transformer vaults, located on slopes at the side of the highway and spaced approximately one mile apart, are used to reduce the power supply from 4160 volts, 3 phase primary, to 480 volts, 3 phase

secondary. These transformer vaults are equipped with cutout switches and fused branch circuit cutouts to permit isolation of any of the secondary circuits. No. 6 direct buried cable distributes 480-v power to the lighting standards. Each lighting standard is equipped with two ballasts, mounted in the luminaire, and each of these ballasts is fed from a different circuit. Manual circuit breakers located in each of the ventilation buildings permit the operators to switch off two tubes in each luminaire over the entire project.

The maintained illumination intensity at the present time is somewhat higher than the designed 0.6 footcandle, since the fluorescent tubes are new and the luminaires are clean.

Variations With Background

Continuous lighting is installed on all roadways in urban areas where background lighting from homes or illuminated signs tends to affect the motorist. Where the project passes through rural areas, the lighting is limited to ramps and roadway sections in the immediate vicinity of interchanges. Underpasses are illuminated with single tube subway type luminaires mounted on the wall of piers. These units are fed from alternate circuits.

The 845 standards and luminaires are fed from 590,000 feet of No. 4 high-voltage, and 895,000 feet of No. 6 low-voltage cable. A continuous ground network, consisting of 175,000 feet of bare No. 4 copper wire, ground rods, and accessories connects all electrical equipment of the installation.

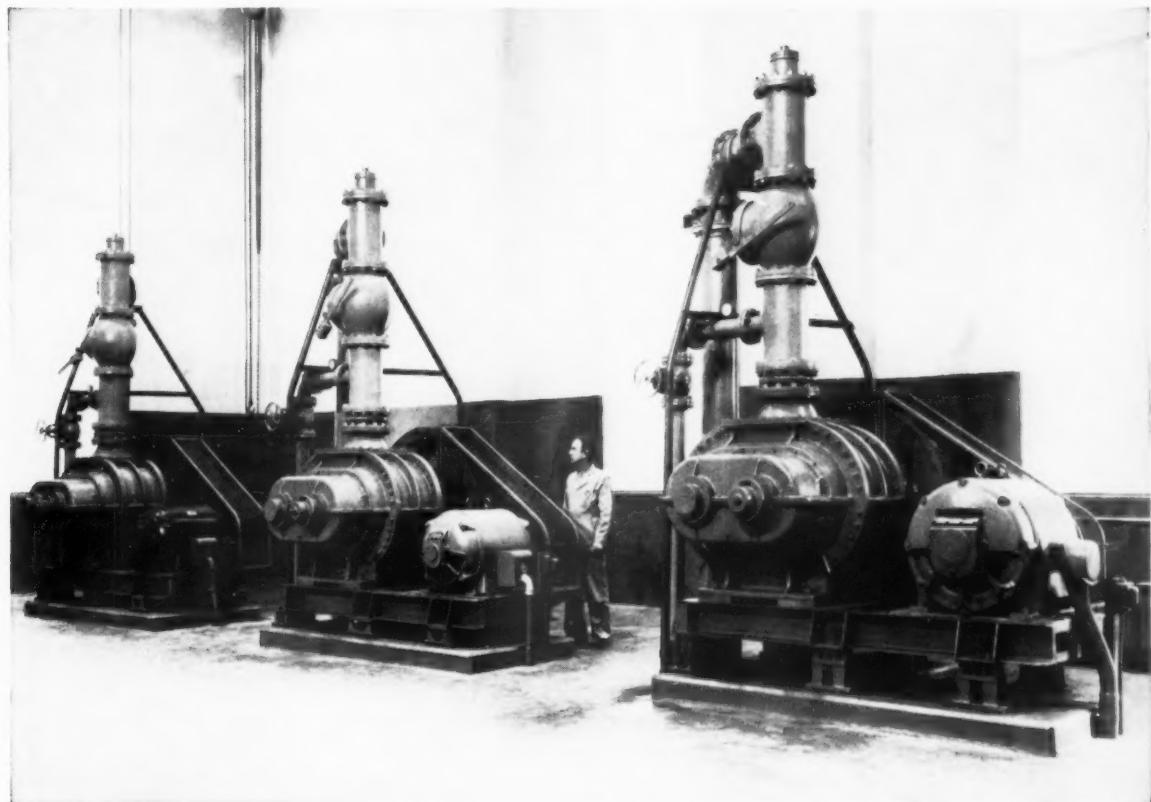
Lighting for Safety

Lighting is turned on automatically from a time switch controlled by astronomic time clocks, and the control circuits are arranged for future installation of photoelectric controls. A gradual light adjustment has been built into the system to acclimate the driver's eye to the changing light upon entering and leaving the tunnel.

Where sections of roadway lighting start or stop, the spacing between poles is graduated to guide the motorist carefully in or out of the illuminated area. The results observed to date have been gratifying. Distribution is uniform, and despite the relatively low intensity, discernibility is excellent.

Individual Study Required

Not all of the features of the Baltimore project would apply to other bypass lighting installations, and the consulting engineer should never accept the solutions found by others without a full study of the special problems of his own projects. Certain principles do hold, however, and many of them are illustrated in the design of the Baltimore Harbor Tunnel installation. ▲▲



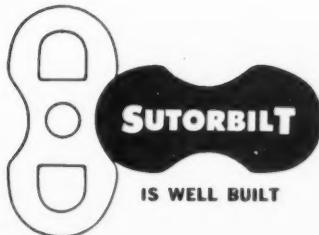
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Building or Modernizing?

Be sure your plans include power distribution equipment engineered to handle tomorrow's heavier electrical loads

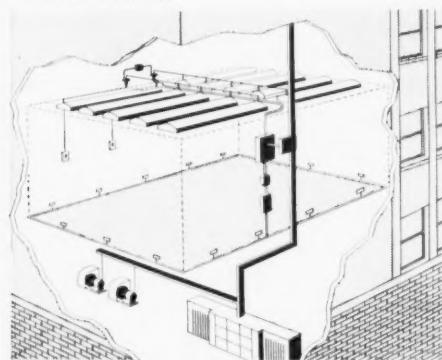
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* Identical to 265/460Y.



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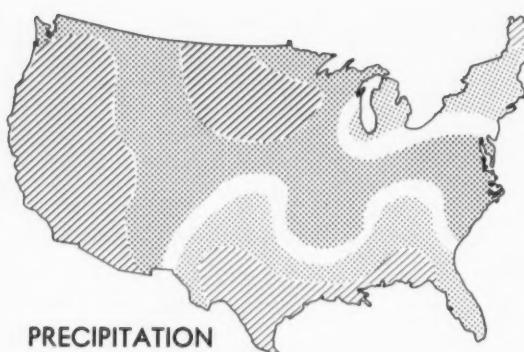
GENERAL ELECTRIC



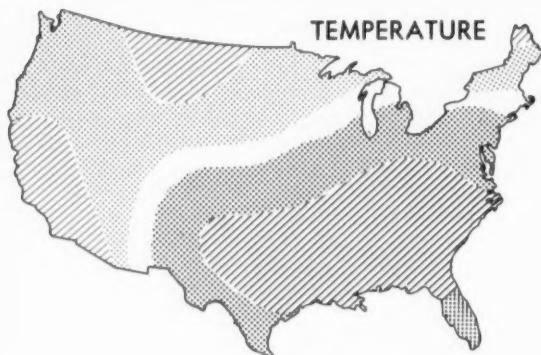
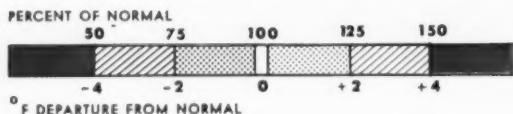
KRICK WEATHER OUTLOOK

APRIL 1959

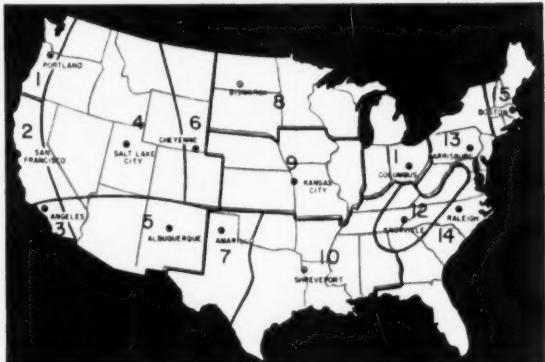
Prepared Exclusively for CONSULTING ENGINEER



PRECIPITATION



TEMPERATURE



CONSTRUCTION DAY FORECAST LOCATIONS

CONSTRUCTION DAY CRITERIA

To be considered a construction day on these charts, the day's maximum temperature must be more than 38 degrees. There must be less than six inches of snow on the ground. There must be less than six hours of active precipitation during the period between the hours of 7 a.m. and 5 p.m. There also cannot have been more than one inch of rainfall on the preceding day.

APRIL HIGHLIGHTS

During April, relatively mild temperatures are in prospect over much of the United States. However, a slightly cooler than normal month is expected in the southeastern section of the country. Near normal temperatures are expected in a belt extending from the Galiuro Mountains in southeastern Arizona up through Nebraska and the Great Lakes region to the southern portions of New England. This belt divides the cooler than normal temperatures in the South from the warmer than normal temperatures in the western United States. Warmest readings as compared to normal are likely in California and Montana. Look for predominantly drier than normal conditions throughout the continent with the area west of the Continental Divide expected to receive only about three-quarters of the normal seasonal precipitation. Much drier than normal weather also is expected in the Dakotas and Minnesota. Near to slightly above normal moisture is anticipated from the Lake Michigan area eastward to the Atlantic coast including the New England states. Throughout Texas and Gulf Coastal states above normal rainfall is anticipated, with the immediate coastal regions and central Texas likely to receive much above normal moisture. As a whole, look for favorable construction weather throughout most of the country. The major exception to this will be the southern regions of the country, where frequent and heavy storminess accompanied by cooler temperatures will produce fewer favorable construction days.



TEAR OUT ALONG PERFORATION.

CONSULTING ENGINEER

These forecasts are prepared by Irving P. Krick Associates, Inc., the world's oldest and largest weather engineering firm. The forecasts are based on methods developed by this group at California Institute of Technology prior to World War II. After the War, the methods were adapted to high speed electronic computing machines to shorten the time required to solve the complex problems of the atmosphere. Ultra-long range forecasts, up to a year or more in advance, are now available. Information on other Krick weather services is available by writing to the home office of the firm at 460 South Broadway, Denver, Colorado.

CONSTRUCTION DAYS

APRIL 1959 ESTIMATES															
LOCATIONS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HIGHEST	30	30	30	30	30	29	30	29	29	30	28	30	29	29	27
LOWEST	25	25	27	25	29	19	24	12	23	26	22	26	21	26	21
AVERAGE	27	29	29	28	30	24	28	24	26	27	25	28	25	27	25
ESTIMATE	29	30	30	28	30	25	27	27	28	29	27	29	26	28	26

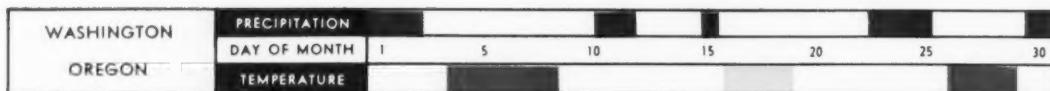
These estimated construction days for key cities in the United States should be interpreted as an average of estimated conditions over the forecast area. To obtain the best results, the forecast number of construction days should be compared with the temperature and precipitation anomaly maps and the timing estimates to determine the probable number of construction days in your locality. The forecast construction days are based on average construction day requirements as defined under "Construction Day Criteria," and should be adjusted for individual operations.

MAY AVERAGE AND RANGE*															
LOCATIONS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HIGHEST	30	31	31	31	31	31	31	31	30	30	31	31	30	31	30
LOWEST	22	29	28	28	30	19	28	25	25	25	25	26	23	28	23
AVERAGE	28	30	31	29	31	27	29	29	28	27	28	28	26	30	26

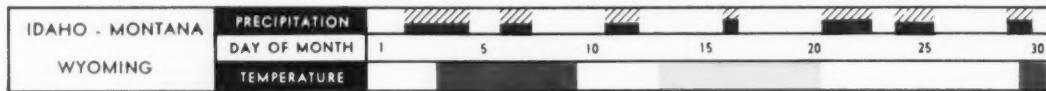
JUNE AVERAGE AND RANGE*															
LOCATIONS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HIGHEST	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
LOWEST	25	28	29	27	29	26	28	24	24	27	26	27	24	26	23
AVERAGE	28	29	30	29	30	28	29	27	27	29	28	28	27	28	26

*Historical Average, Not a Forecast

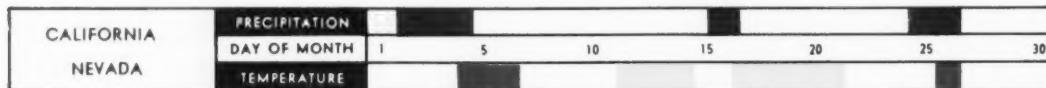
APRIL 1959 TIMING OF STORMINESS



A much drier than normal month is expected throughout this area. The storminess shown on the timing bar following the 10th should concentrate mainly in the northern portions of Washington; storminess around the 24th is not expected to be too important in coastal regions.



Storminess indicated around the 3rd is anticipated to effect principally southern Idaho. The prolonged period of cool weather early in the month will bring minimum temperatures in the 20's. Storminess around the 24th is expected to be more general east of the Rockies.



A much drier than normal month is expected throughout California and Nevada during April. Look for important storminess to occur during the period centered around the 3rd. Showers indicated for around the 25th are expected mostly in northern coastal sectors.



The storminess indicated around the 5th is expected to effect mostly Colorado and Utah. Western portions of the area will receive only about three fourths of the normal monthly moisture. Showers indicated around the 17th and the 28th are likely to concentrate principally in New Mexico.



A slightly warmer than normal April is expected throughout this area, although nighttime temperatures will fall into the teen's during the indicated cool periods. The mild weather anticipated around the 18th of the month is likely to be noticeable mainly in the western sectors.



Near to slightly below normal temperatures are expected to occur during April. Look for minimum temperatures to range in the mid and upper 20's during the cool period indicated around the 7th to the 10th. Important moisture is likely during the first 10 days of the month.

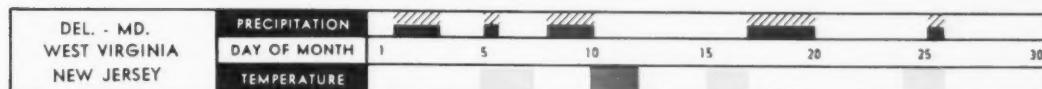


Average temperatures during April are expected to range from near to slightly above normal throughout the Great Lakes region. The opening month storminess is expected to effect mainly the southern half of the area. No extremely cold temperatures are anticipated during the month.

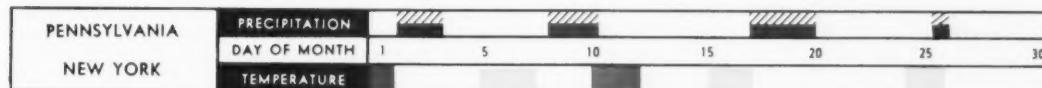
SIGNIFICANT WEATHER EVENTS

RAIN	
SNOW	
WARM	
COLD	

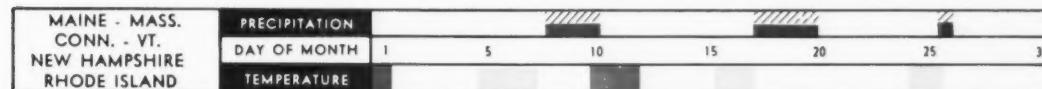
The timing bars below are intended to indicate periods of important general storminess and important departure from temperature normals in areas indicated. They are highly accurate over the area indicated, but are too general to pinpoint small local storminess or showers. Allow one day on either side of indicated storm or extreme temperature periods for general planning. Combination rain or snow shading indicates either one or both.



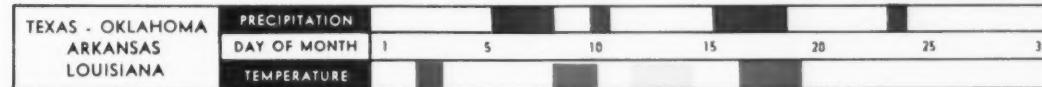
The storminess indicated on the timing bar for around the 2nd of the month is likely to be heaviest in the New Jersey-District of Columbia area. Cooler than normal average temperatures will prevail throughout this area during April.



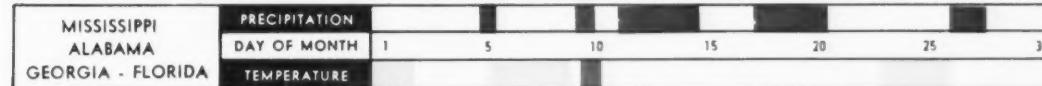
The cool interval indicated at the start of the month is expected to effect mainly northern and western sectors of New York. The storminess indicated for a period of a day or two around the 2nd of the month is likely to be heaviest in southern portions of Pennsylvania.



Look for near normal temperatures and slightly above normal moisture throughout this area during April. No extremely cool temperatures are anticipated during the month, and minimum readings during the two brief below normal periods are expected to range in the mid 30's.



Storminess indicated for around the 7th of the month is expected to be heaviest in the northern half of the area and may be accompanied by tornadoes in some sectors of Arkansas. During the cool intervals, minimum temperatures are expected to be in the mid and upper 30's.



Much above normal moisture can be expected in the Gulf coastal sectors of this area. A tornado threat is anticipated in the lower Mississippi Valley around the 8th of the month. Average temperatures are expected to range below normal throughout this area.



Cooler than normal average temperatures are expected throughout the upper South during April. Look for the threat of tornadoes in the Mississippi Valley around the 8th. During the cool period, minimum temperatures in the upper 30's are expected as far south as the Carolinas.





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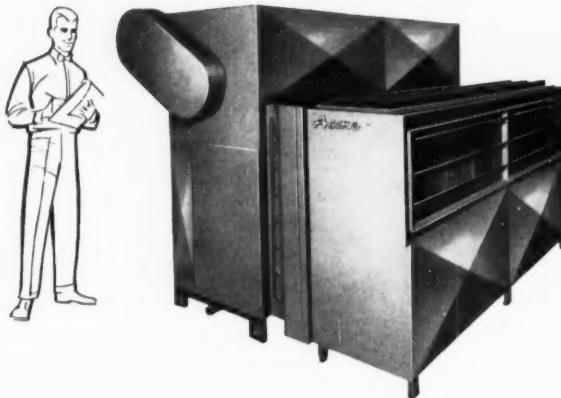
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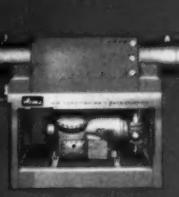
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Air-Cooled Condensers



Self-Contained Air Conditioners

Field Notes

MARJORIE ODEN, Eastern Editor

Downdraft from Upstate

A POLITICALLY INSPIRED attack against consulting engineers doing highway design in New York State has taken a surprise turn and may become a powerful argument against the creation of "super" highway departments.

Beginning with the scream headline "Consultant Engineering Fees Spur Bid for State Probe," the investigation has simmered down in-

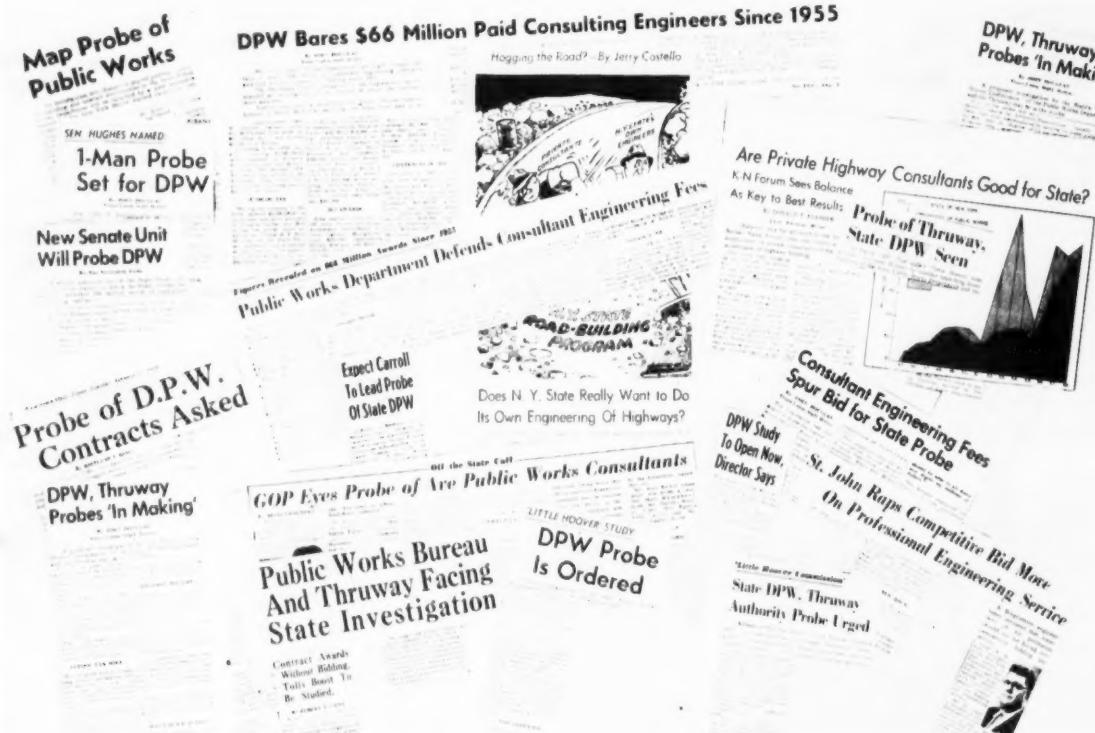
to a discussion of economy in highway design.

Cost-Accounting System

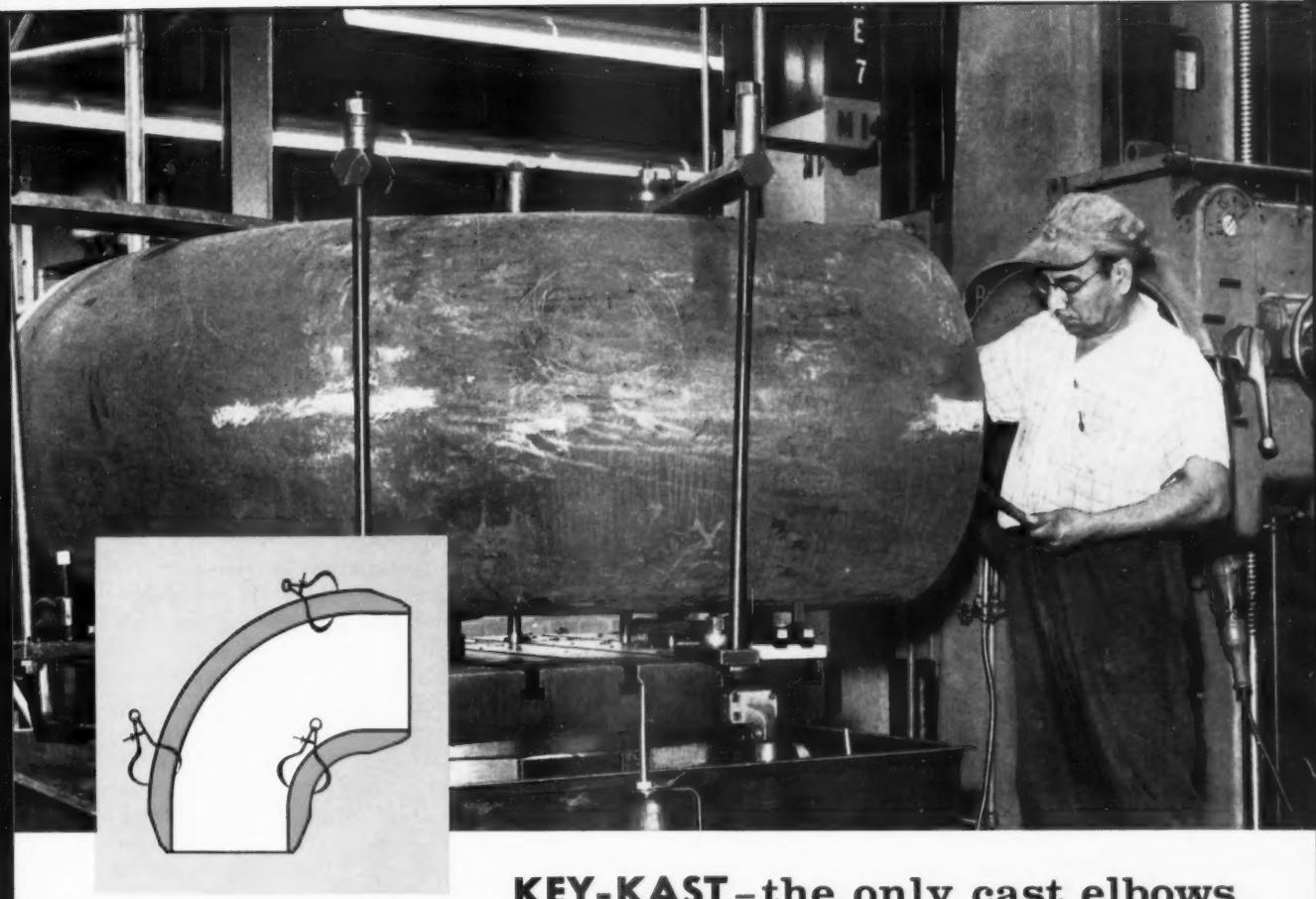
As the result of one panel discussion, conducted by an Albany newspaper, public attention has been focused on the fact that many persons simply assume design by highway departments is more economical than design by consulting en-

gineers. Yet, the Department of Public Works in New York State does not show comprehensive costs with its present accounting system. Costs of office space, fringe benefits, and administration have not been included in past design costs compiled by the Department.

And at least one newspaper in Albany has suggested editorially that "the State should have a bet-



Bold headlines in New York State newspapers set stage for probe of DPW's awarding of consultant contracts.



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AFFILIATE: Conco Building Products, Inc.—Brick, Tile, Stone

ter cost-accounting system so that it knows whether it saves or loses money on hiring consultants—and how much."

The issue has not been settled, and there may be more name calling and suggestions of political collusion before it is over.

How It All Started

Investigations of this type always have many motivations, but the explanation heard most frequently is that it all began with a highway project with a large fee involved, which was let to a Syracuse consulting engineer last summer.

Senator John H. Hughes of Syracuse, in an exclusive interview, said "I didn't get an answer that satisfied me as to why this particular engineer got the job." In December, the Senator heard that another substantial contract was about to be signed with a consulting engineer. He asked that a public hearing be held on the project. This request was ignored, but the contract with the consulting engineer was not signed.

Speculation around Albany is that the Senator's interest in the topic of consulting engineers' fees began when a number of consultants in his home territory complained because they were not getting state work. According to the *Syracuse Post Standard*, "This happened in the closing days of the administration of Governor Harriman. Hughes was told that the purpose of the speedup in awarding the design contract was to channel the business to a political favorite. The Syracuse senator said he learned on reliable authority that the design fees involved would have been about \$2 million."

Investigation Requested

Senator Hughes then called for an investigation into the methods used in awarding contracts to consulting engineers. Although this was covered mostly in the Upstate newspapers, even the *New York Mirror* came out with the an-

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Write for bulletin 55-1, showing the wide variety of designs and sizes available in both field-erected and shop-assembled* steam generators, or ask the nearest Wickes representative to call on you for full information.

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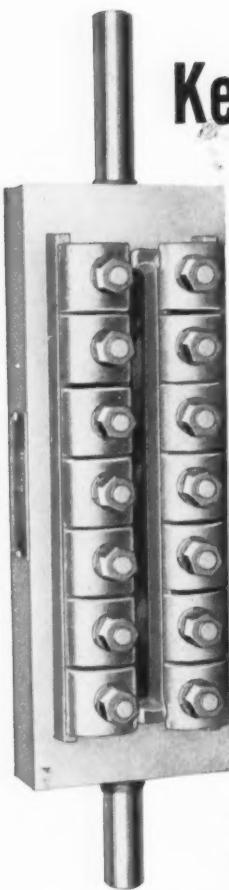


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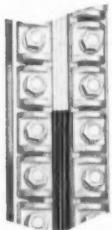


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nouncement that, "An investigation into charges of payroll padding, wasteful spending, and contract irregularities in the State Public Works Department will be launched by a joint legislative committee . . . The GOP lawmakers did not indicate the extent of the suspected irregularities. But they intend to dig into such charges as:

"1. Complaints that the Public Works Department hired dozens of high priced 'consultants' to render services on projects that were never contemplated.

"2. Architects and engineers were paid fancy fees to inspect sites on which the State never contemplated doing any construction work.

"3. Public Works officials scheduled projects far beyond the size of appropriations voted for such projects.

"4. As many as 20 workers were listed on payrolls of some projects when only five or six actually were engaged in the work.

"5. Rumors of kickbacks by contractors to politicians and, in some instances, to State employees."

Senator Hughes said, "Many things have been brought to my attention which warrant . . . an investigation." He was quoted in the Albany *Times-Union* as explaining that he "objected to the procedure under which the Superintendent of Public Works had sole authority to let a design contract to a consulting engineering firm without advertising for bids or giving public notice."

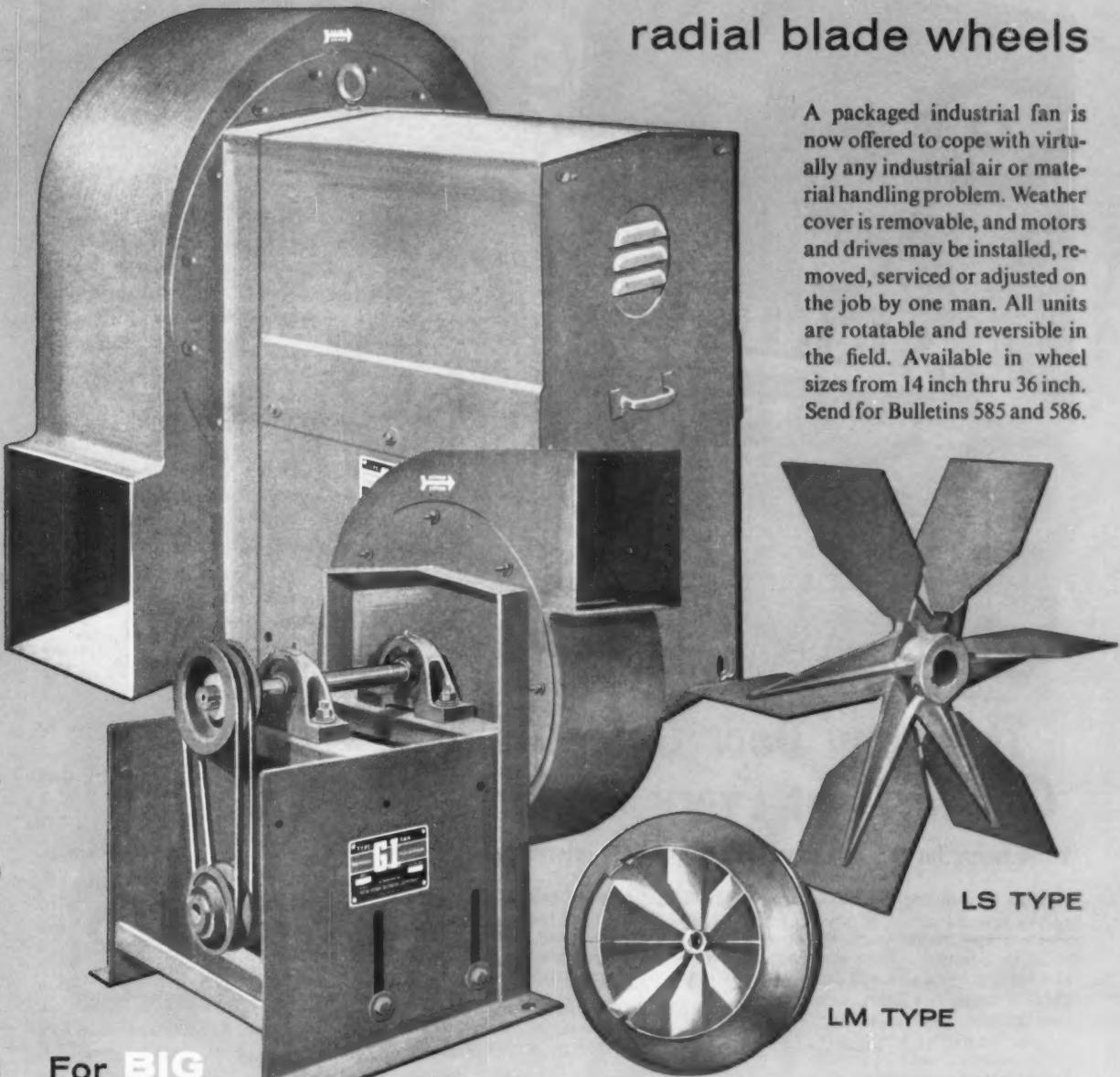
Under the Senator's resolution, the investigation was to be conducted by the Senate Finance Committee and the Assembly Ways and Means Committee. It also was announced that the State's "Little Hoover Commission" would investigate the awarding of contracts to consulting engineers.

The Department of Public Works defended its position, contending that professional persons were hired in a professional manner. Even during the mudslinging, no

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mention was made of competitive bidding except by the Senator, who initially felt it was the proper procedure.

Probe Redirected

Soon, the "Little Hoover Commission" announced that its investigation was not similar to that suggested to the legislature by Senator Hughes. The Commission chairman said his agency's investigation would be "a general study of department [DPW] functions — an efficiency study," rather than a probe of engineering contracts.

It also became apparent that the Senator was not doing too well in getting backing for his investigation in the legislature. Instead of appointing a large committee, the legislature made Senator Hughes a one-man investigation committee, and under Senate rules, one-man hearings cannot be conducted.

According to the *Times-Union*, "the investigation has been accepted with reservations by elements of the Republican leadership." The legislature is made up largely of lawyers, and that newspaper added, "One powerful Senator told this reporter, 'I don't bid for legal business, and I don't see any reason why a professional engineer or architect should have to bid either.'"

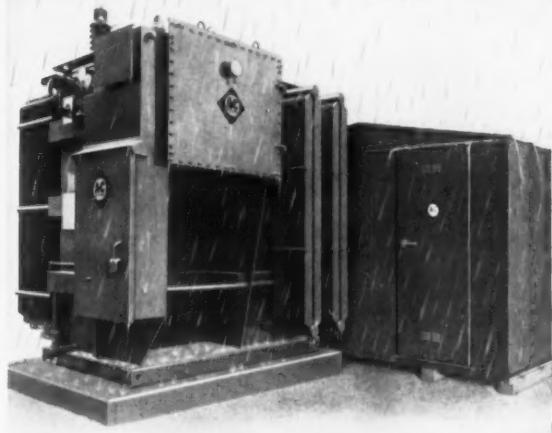
The story also mentioned that "Sen. Hughes has admitted that it may very well be that we can't order bids" on consultant contracts, but he says that if this is so, an advisory board should be set up to screen the contracts awarded by the DPW Superintendent."

Panel Discussion Enlightening

The Albany *Knickerbocker News* held a panel discussion at which were present representatives of the Department of Public Works and Charles Sells, Consulting Engineer, who has done a considerable amount of design for the DPW and who was New York State Superintendent of Public Works from 1943 to 1948. This discussion, pub-

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Check these important "accessibility" features of Allis-Chalmers new 4.16-kv outdoor switchgear:

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lished verbatim, is credited with turning the investigation from a destructive to a possibly constructive action for the consultant.

Among the questions were: Is this situation (the use of consulting engineers for highway design) desirable from the standpoint of economy?

John F. Lucey, assistant superintendent for engineering and research of DPW, said, "The program on which we are embarked now — that is, the Federal Interstate System, is of known duration. It will end in 1972. If we built up the DPW to take care of that program without consultants, it would be overexpanded by at least half when the program ended."

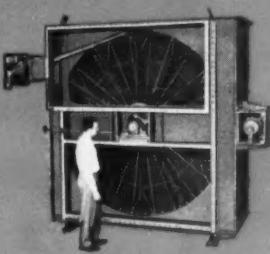
Sells added, "The State's accounting system doesn't take into consideration such things as overhead, rent, telephones, clerical service, transportation, vacations, sick leaves, pensions, insurance, administration, and other direct but necessary expenses. In addition to all those expenses, the consultant must operate his staff with sufficient efficiency to include taxes and profit. When a consultant performs a job the exact cost of his services is always known and this is not true in the case of similar work performed by public agencies."

"When a consultant's job is finished, the cost of his services ceases, and it is his own responsibility to carry on the costs of his organization. He must seek other work, perhaps in other states, or dismiss the surplus employees."

"When a public agency completes a project, unless there is another immediately available, the process of dismissal, under average Civil Service rules, is usually slow and cumbersome, with the result that a department is liable to find itself overstaffed during periods of slack work."

"Many states require the consultant to carry 'hold harmless' insurance protecting the state against cost of errors. They have no such insurance protecting them against

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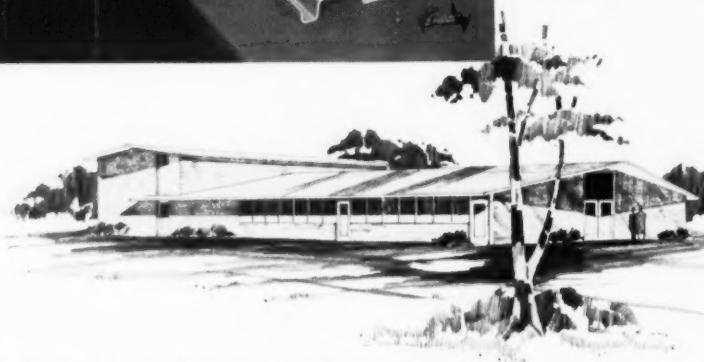
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Because the acoustic performances are in vertical webs only, the possibility of dusting is completely eliminated. Spans to 10 feet are practical with Acoustideck.

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Milcor Acoustideck cuts cost on roof and ceiling for school

Acoustideck serves as both roof deck and acoustical ceiling of modern, fluted design. It goes up fast in any weather, saves on structural, helps earn favorable insurance ratings.

Tests by Armour Research Foundation show that Acoustideck has a Noise Reduction Coefficient of .70. This satisfies the requirements of classrooms, gymnasiums, tank rooms, offices, industrial plants, and other noise-problem areas.

Acoustideck is Bonderized, then flow-coated with a prime coat of epoxy-resin enamel, oven-baked to abrasion-resistant hardness. It is available also in galvanized steel and aluminum.

See Sweet's Architectural File, section 11a/In — or write for catalog 241.

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With Acoustideck, spans to 10 feet are practical. Acoustic perforations are in vertical webs only, where load-carrying ability is affected least.

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similar errors that might be made by their own employees.

"The discussion at this time seems academic anyway, as it is estimated that for the next 15 years the projected highway program will require the employment of every ounce of highway talent, regardless of whether it be privately or publicly employed."

Efficiencies Compared

A prominent panel speaker, Admiral Lewis B. Combs, head of the Civil Engineering Department at Rensselaer Polytechnic Institute, said, "Counting all State costs, I don't know whether State engineers can do a job more economically. I don't think government can ever be organized on a business basis."

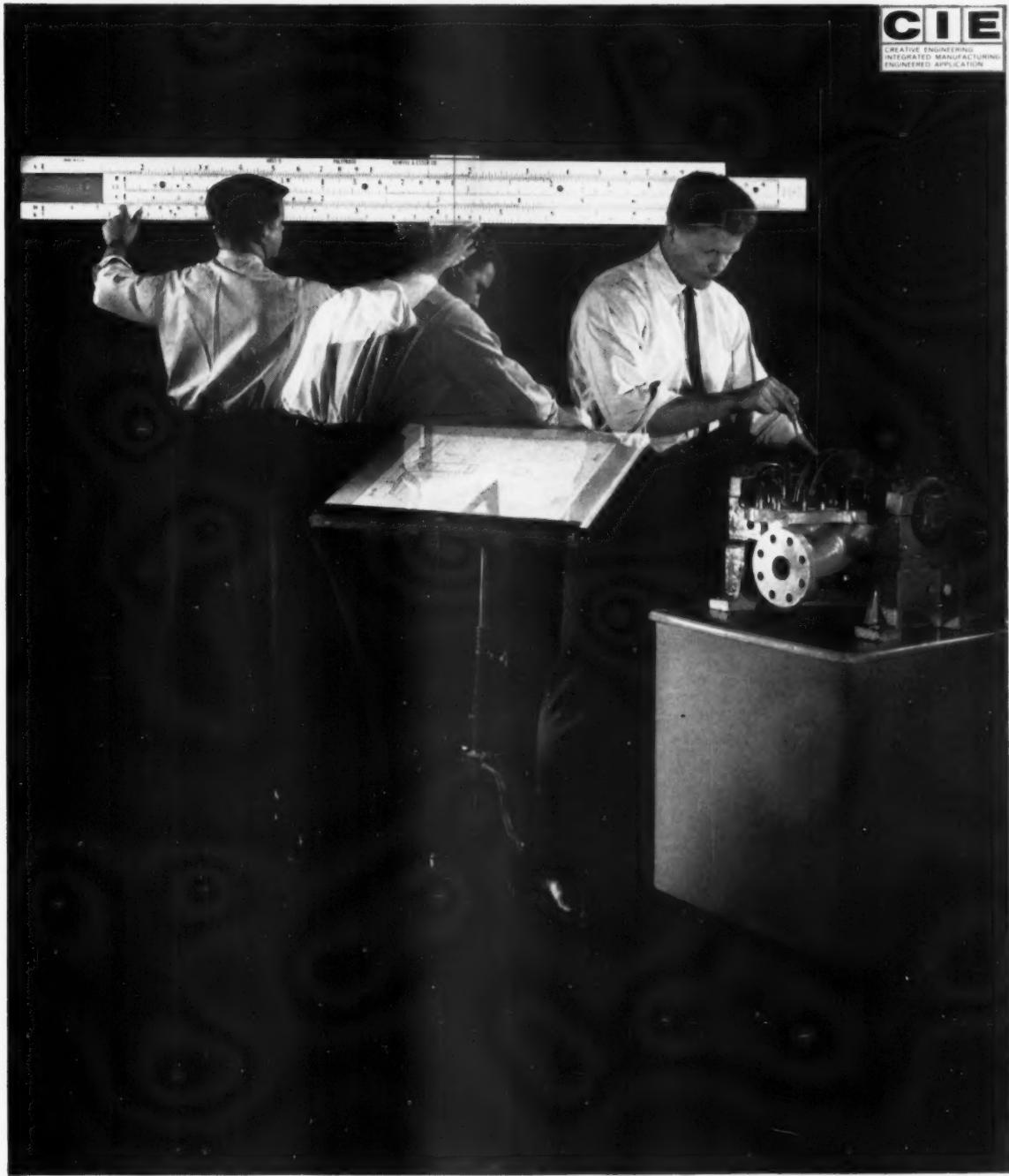
Asked if he was advocating that all public agencies be done away with, Admiral Combs said, "Not at all. The State has to exercise management control. I'm simply casting a doubt on what seems an automatic assumption that the DPW can engineer a project more cheaply than a private consultant."

In late February, Senator Hughes introduced what he described as a "stopgap measure" to the Senate. This bill would amend the present laws to insist that the Superintendent of Public Works go through the Division of Construction in the hiring of all consulting engineers. The Senator said, in repeated interviews, that he had no evidence of wrongdoing, but felt that a few men should not be able to "sit down and divide up millions of dollars." Present laws authorize the Superintendent of Public Works to retain consulting engineers.

DPW Reaction

We then went to the New York State Department of Public Works to see what the people there thought of this situation.

Everyone repeated that the DPW currently hires professional engineers in a professional manner. No changes are being contemplated in either the extensive use of consult-



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Highest Quality Water Filtration in large volume with SPARKLER DIATOMITE FILTERS!

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Diatomite filtration of water in large volume is a comparatively recent development by Sparkler engineers. For many years the distinct superiority of diatomite filters in producing filtered water of highest clarity, with reduced bacteria count and with absolute uniform quality has been recognized by engineers in the chemical and other industrial fields, but old style diatomite filters were limited in volume.

Now the new large volume diatomite filters engineered by Sparkler have been tested in hundreds of successful installations in many industries and for municipal water supply, and have almost completely replaced sand filters for swimming pool filtration in schools, clubs, and municipal pools because of the greatly reduced chemical treatment necessary, to produce safe water.

This new phase of water filtration is worthy of careful investigation and study by all consulting engineers who are engaged in large volume water filtration.

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A closed tank, pressure filter, with self cleaning features. The spent diatomite cake is peeled off the plates with the exclusive Sparkler Hydro-Scrapper knife edge pressure spray and is washed out of the tank through the sloping bottom drain. The complete cleaning operation including precoating and recirculating for clarity ready for resuming operation is less than 30 minutes; a completely new uncontaminated filter media is thus provided. Filter element and spray tubes have no metal to metal contact with tank, thus providing electrolytic protection. Fully automatic electronic operation can be furnished.

Capacities are available in a single unit for 1,500,000 gal. per 24 hr. operation.

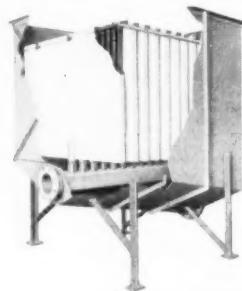
Approximately $\frac{1}{4}$ the floor space is required by this filter as compared with a sand filter and the installed cost is $\frac{1}{2}$ that of sand.

MODEL HCV

A vacuum type filter that operates with an open tank and with full visibility of filtering process at all times. Plates are plugged into a self sealing outlet manifold at the bottom of the tank. Cake is removed by flushing off with hose. Spent cake flows out the self draining bottom through a T on the inlet supply pipe. Filter elements have no metal to metal contact with tank, thus eliminating electrolytic action.

This filter is available in capacities up to 900,000 gal. per 24 hr. operation.

Both filters have synthetic cloth covered plates that are removable without bolts or fastenings.



Write for bulletins and engineering data on these filters.

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ing engineers for design (80 percent on a dollar volume) or the manner in which the engineers are selected. And nobody wanted to be quoted.

One spokesman said he could not see why Senator Hughes is upset about the manner in which consulting engineers are retained. Although the present law specifies that the superintendent select consulting engineers, DPW red tape does not work that way.

DPW System

To start, the district engineer suggests a consulting engineer for a project in his district. The superintendent must agree with this suggestion. The chief engineer also is consulted and the chief engineer is in the Division of Construction. "So why did Senator Hughes want to specify that the consultants be retained through the Division of Construction?"

Assuming that everyone agrees, the consultant's name and details of the project go to the Division of Budget. If all is well, the project brochure next goes to the Civil Service Department. "We don't want to run the risk of ever awarding a contract to an engineer who is on our payroll. Also, we must verify that State engineer employees are not sitting around idle." The attorney general's office examines details of the contracts. Then the comptroller gives final assurance that the project funds are available.

Rare Statistics

Early this year, it appeared as if New York State consulting engineers might be in for some bad publicity. The many would be blamed for the political indiscretions of the few. But at this point it looks as if Sells, and other panel members, might have planted the seed that will result in some rare statistics — proof, perhaps, that the use of consulting engineers by state highway departments saves the taxpayer money. □



AUDIO NEWS

for consulting engineers



HIDDEN CEILING MICROPHONES FOR AUDIENCE "TALK-BACK"

Unusual meeting room in Socony Mobil Building part of comprehensive communication system designed for complete flexibility.



Eight RCA sound systems dovetail into one versatile network in the 42 story Socony Mobil Building in mid-Manhattan. Functions performed by the sound systems include public address, music distribution, air raid warning, fire alarm, selective paging and conference recording and playback.

The conference area of the Socony Mobil Training Center provides an extremely flexible combination of sound and audio visual facilities. The area can be divided into four separate conference spaces, each provided with a film projection room and sound system. To accommodate large groups, sliding doors permit combining all four rooms into a single meeting room seating 250 persons.

CONFERENCE ROOM SOUND SYSTEM

An unusual feature of the conference room is the recessed mounting of microphones and loudspeakers in the ceiling so that comments and questions during meetings will be heard clearly in every part of the room. An automatic circuit eliminates feedback between adjacent microphones and speakers.

With this system the communications set-up can be tailored to the room arrangement. Conference members

may use microphones and speakers independently in each room. Or, when all four rooms are combined, all of the communication devices may be put on the same circuit and controlled from the central control console. Minutes of conference meetings may be recorded merely by switching microphones into a tape recording system.

Thirteen Accordion Cone Speakers and nine Type BK-1A Microphones are used in the conference area to give effective sound coverage and intelligent talk-back at meetings. BK-1A Microphones were chosen for this application for these reasons:

1. Smooth response over essential audio frequency range. (Response: 60-10,000 cps.)
2. Frequency characteristic independent of source distance.
3. Insensitive to mechanical vibrations.
4. Non-directional for frequencies below 2,000 cycles.

Specifications, characteristics and application information on the BK-1A Microphone and 14 others can be compared at a glance in a convenient new folder, the RCA Microphone Select-A-Guide. We will be happy to send a copy for your files.

AUDIO NEWS for consulting engineers

MULTI-PURPOSE SYSTEM FOR SOUND AND FIRE ALARM AT FORD PLANT



Power amplifiers are rack-mounted for easy access.



Control center for the system is in plant protection office. Located next to the microphone switch is the "panic" button used to sound emergency evacuation alarm.

An impressive saving of miles of wire and thousands of dollars in equipment was accomplished at Ford Motor Company's Wixom, Michigan, plant by designing a multi-purpose system for paging, public address, programming signals, background music, as well as *Underwriters' approved fire alarm*.

When a fire alarm is turned in, a bell rings in the plant protection office, a light flashes the location of the alarm box, and a code signal goes out over the sound system, giving the location of the fire.

Paging is by sound signal instead of voice. Key personnel are assigned code designations which are fed through a dial code machine connected to the phone system. For public address or voice paging, when necessary, microphones are provided in key locations.

The master clock is tied into the sound system, automatically signalling shift changes and lunch periods. Background music is limited to lunchtime in the cafeteria, but will probably be expanded throughout the plant at a later date.

As an additional safety precaution, a 20,000 cycle supervisory signal, automatically issued at 15 minute intervals, checks the entire system. Equipment failures are indicated in the plant protection office by the sound of a buzzer, and a pilot light indicates the position of the faulty equipment on a control board.



NEW DUPLEX 8" SPEAKER OFFERS GOOD RESPONSE AT LOW COST

Excellent performance at low cost can be expected from the new duplex 8-inch speaker (MI-12454B) now available from RCA. This speaker is particularly suitable for classroom use and for indoor sound distribution and intercom applications.

The MI-12454B is a high quality speaker, with a frequency response of 50-15,000 cycles. It is equipped with a mechanically coupled high frequency cone and uses a 3.16 ounce Alnico V magnet. A spring brass magnet clamp holds the magnet in place without the use of cement or solder.

Voice coil impedance is 3.2 ohms at 400 cycles. A multi-tap line matching transformer provides taps for impedances of 700, 1400, 4000, 8000 or 16,000 ohms. Power handling capability: 10 watts.

Additional Features:

- Moisture resistant cone, voice coil assembly and suspension.
- Stamped steel frame welded to yoke assembly and zinc plated.
- Air gap accurately held in alignment by brass centering ring, welded in position.

Catalog sheet S.4151 gives complete specifications on the MI-12454B Speaker. Also, a new folder, "Loudspeaker Select-A-Guide," permits instant comparison of 24 RCA Loudspeakers, drivers, horns, and auditorium speaker systems. This file-size folder illustrates each item and covers specifications and application data. Ask for a copy.

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SOUND PRODUCTS

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Four-inch F&P magnetic flowmeter measuring influent from the grinder at the Gainesway Subdivision Sewage Treatment Plant, Lexington, Kentucky. Accuracy is unaffected by piping configurations or valve placement. Consulting engineer: Marion C. Welch, Lexington, Kentucky.

F & P OBSTRUCTIONLESS FLOWMETERS GROW WITH THE PLANT

OBSTRUCTIONLESS . . . that's the big reason why more waste treatment plants are installing F&P magnetic flowmeters every day. No restrictions . . . no obstructions mean no clean-out problems whether you're metering raw sewage, effluent, or sludges. F&P magnetic flowmeters are even provided with built-in brushes for cleaning electrodes in a matter of minutes without shutdown.

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ment without custom matching. Accuracy is independent of viscosity, density, or turbulence . . . unaffected by piping configurations or valve placement. You have complete freedom of plant design.

Available in sizes from $1\frac{1}{2}$ " to 72" diameter, the meters can be installed in any attitude and will measure full pipe flow in either direction without accessories. Don't overlook the fact that wide rangeability and high accuracy make these meters a natural choice for billing or "cash-register" applications.

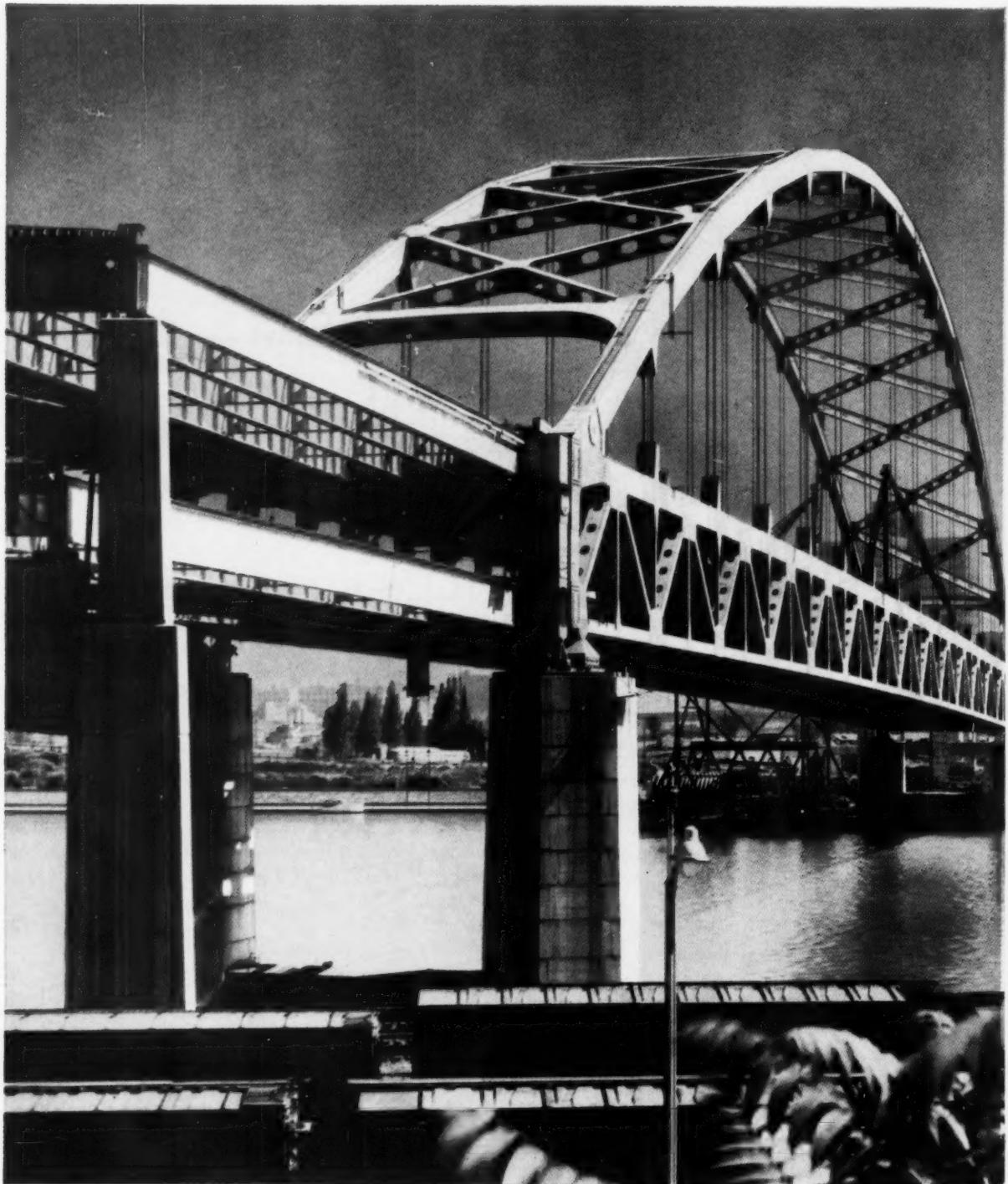
Get the facts on Fischer & Porter magnetic flowmeters NOW! Contact the F&P field engineer nearest you, or write for Catalog 10D1416. Fischer & Porter Company, 3349 Fischer Road, Hatboro, Pa. In Canada, Fischer & Porter (Canada) Ltd., 2700 Jane Street, Toronto, Ontario.



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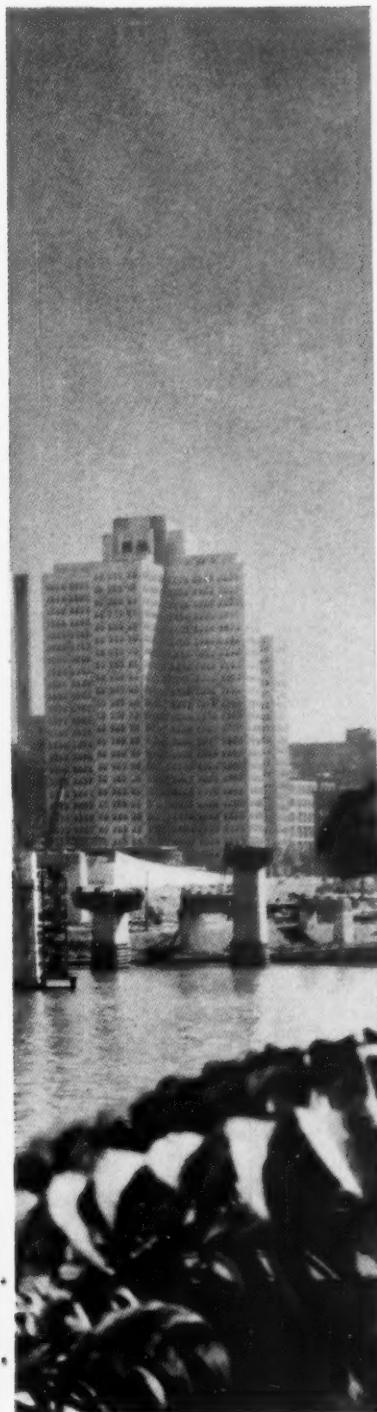
Only span of its kind in the world . . .

New Fort Pitt Bridge built with cost-saving





MAN-TEN High-Strength Steel



Under the shiny new paint on Pittsburgh's Fort Pitt Bridge is a steel with a reputation—USS MAN-TEN High-Strength Steel. More than two-thirds of the 8,000 tons of steel used in the 750-foot span is USS MAN-TEN brand—a steel that delivers high strength (50,000 psi min. yield point) with economy.

The bridge is regarded by engineers as the most unusual structure in the entire Penn-Lincoln Parkway System. It is a double-deck, tied-arch design and will carry four lanes of one-way traffic on each level.

For the heavily stressed members, high-strength steel answered the problem of getting higher allowable stress per dollar by avoiding unnecessary weight. USS MAN-TEN Steel was used in all chords, most diagonals and verticals, and all portal members including end floor beams. The roadways are supported by 112 pre-stressed USS Tiger Brand suspender ropes, each $3\frac{1}{4}$ " in diameter with an ultimate strength of 475 tons.

Other USS High-Strength Steels available for construction include USS TRI-TEN High-Strength Low-Alloy Steel which, like USS MAN-TEN, has a minimum yield point of 50,000 psi and which is

particularly recommended for welded structures. USS COR-TEN High-Strength Low-Alloy Steel also has a 50,000 psi minimum yield point and, because of its outstanding resistance to atmospheric corrosion and superior paint adherence qualities, is a "natural" for riveted structures located in corrosive areas. Where an extra high yield strength steel is needed, we offer USS "T-1" Constructional Alloy Steel which combines weldability and toughness with 100,000 psi minimum yield strength.

For complete information on any of these steels, write United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

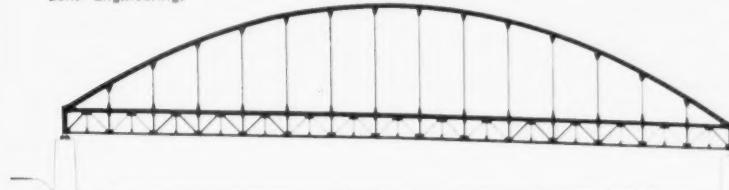
USS, MAN-TEN, COR-TEN, TRI-TEN, "T-1" and TIGER BRAND are registered trademarks

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United States Steel



Some of the men who played major roles in making the new Fort Pitt Bridge at Pittsburgh a reality: left to right are Alan A. Porter, American Bridge Division's Vice President—Construction; George S. Richardson, consulting engineer, designer of the bridge; Leonard J. Curran, District Engineer, Pennsylvania Department of Highways; and Arthur S. Marvin, American Bridge Division's Vice President—Engineering.



Where high-strength steel saves money. Profile of bridge showing parts made of USS MAN-TEN Steel in heavy lines. For these members, MAN-TEN Steel's high strength and relatively low cost made it the economical steel to use.

Mahon METAL CURTAIN WALLS



Bright New Plant and Office Building for Pittsburgh Screw and Bolt Corporation, Mt. Pleasant, Pa. Mahon Aluminum Curtain Walls were employed throughout. The Mahon Company also furnished Five Rolling Steel Doors for this Modern Industrial Plant. Engineers and Builders: The Austin Company, Cleveland, Ohio.

Serving the Construction Industry Through Fabrication of Structural
Steel, Steel Plate Components, and Building Products

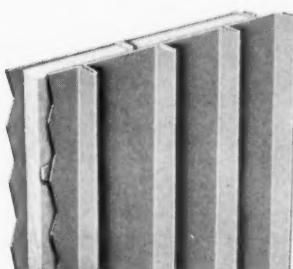
in Bright Metal or Color Offer Designers Greater Latitude in Exterior Treatment!

Mahon Walls can be Erected up to 60 Ft. in Height without a
Horizontal Joint . . . Vertical Joints are Invisible

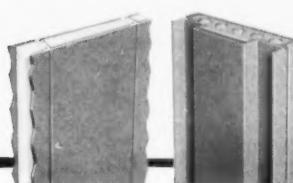
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MAHON FLUTED WALL
FIELD CONSTRUCTED



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Atoms in Action

JOHN F. LEE

Broughton Professor and Head
Department of Mechanical Engineering
North Carolina State College

Concerning George Charles de Hevesy

THE 1959 ATOMS FOR PEACE AWARD was conferred on George Charles de Hevesy, a Swedish chemist, on January 29. Among De Hevesy's contributions to nuclear science was the introduction of tracer techniques using radioactive atoms — now widely

applied in scientific and medical research and in many fields of technology. George de Hevesy is one of a long list of chemists, reaching back to the Curies, who have made the modern science of nuclear energy possible. Unfortunately, in the public mind the contributions of chemists to nuclear science often are overlooked or vaguely attributed to physicists. In fact, "scientist" and "physicist" have become almost synonymous.

Dedicated Career

Professor George Charles de Hevesy was born in Budapest, Hungary in 1885. He studied in Budapest and Berlin, took his doctorate at the University of Freiburg, and then continued his studies in Switzerland and in Germany. In 1911 he went to England to study at Manchester University under Ernest Rutherford, whose laboratory was attracting scientists from all parts of the world because of the pioneering work being done there on the structure and behavior of atoms.

Rutherford had been given a large sample of lead chloride prepared from pitchblende, the natural source of radium, which contained a radioactive degradation product of radium called Radium D. One day Rutherford said to De Hevesy, "If you are worth your salt, you can separate the Radium D from all that nuisance of lead." George de Hevesy tried but failed, and this failure became his first great contribution to modern science. He reasoned that if the two are inseparable, it should be possible to add small quantities of the Radium D to lead in its compounds and thus follow the lead through chemical processes by measuring the

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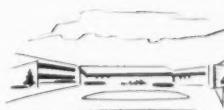
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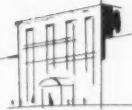
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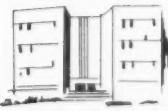
COOLING HEATING CONDITIONER



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Where there's a need, there's a Dunham-Bush product!

The new "CHC" Cooling-Heating Conditioner continues the Dunham-Bush pattern of product progress providing "one-source-one responsibility" for all your air conditioning, heating, refrigeration and heat transfer needs.

"CHC" is a compact fan coil unit for mounting between-the-studs of a wall structure, designed to meet the smaller space and capacity requirements of motels, hotels, apartments and residences. Together with Heat-X Package Water Chillers, Dunham-Bush Pumps and Water Savers, all the necessary equipment to meet complete specifications are provided.

Dunham-Bush "CHC" units are available in two basic sizes—Model CHC-150 and CHC-300. The standard unit is basically designed for free standing use readily adaptable for semi-recessed applications. Each standard unit can be wall mounted, fully exposed or semi-recessed, as required for "off the floor" installations. Matching trim pieces are available for finishing purposes on semi-recessed applications.

Other available features include fresh air wall boxes to meet ventilation requirements calling for the introduction of fresh air up to 20% of the rated CFM; rear discharge sections and grilles to permit discharge of up to 50% of the rated CFM to adjacent rooms where the standard unit is installed on a common interior partition.

Keep up-to-date on the latest! Write for complete "CHC" specifications or call your Dunham-Bush sales engineer.

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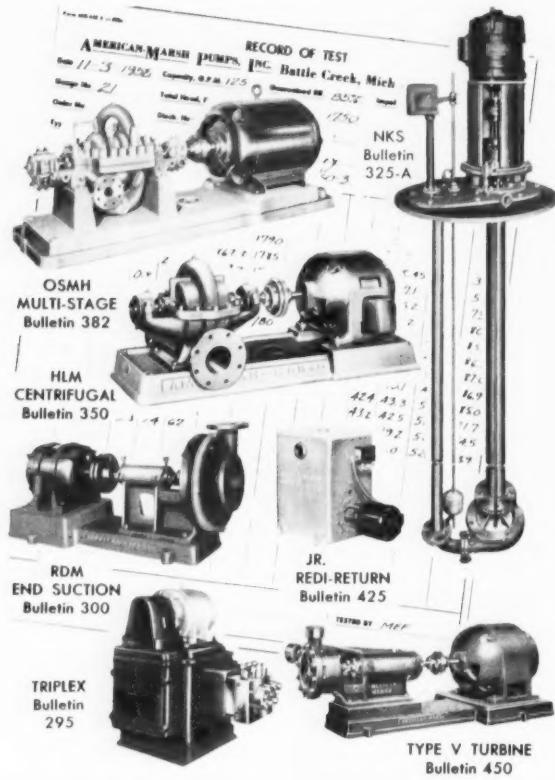
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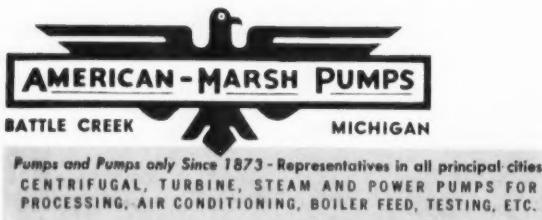
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radioactivity. At the Vienna Institute of Radium Research, in 1912, De Hevesy with F. Paneth began his studies of chemical processes with labeled lead as a tracer.

Isotope Separation

In 1913, De Hevesy was appointed lecturer at the University of Budapest, and he received a professorship there in 1918. During the War, he served the Hungarian government in technical capacities and continued his research on lead compounds. After the war, he joined the Institute for Theoretical Physics, in Copenhagen. Here he worked on the problems connected with the separation of isotopes—species of the same chemical element with slightly different atomic weights. (His failure to separate Radium D from lead while with Rutherford is now attributable to the fact that it is an isotope.) Among other studies during this period, he demonstrated that the naturally radioactive potassium is the heavy isotope of this element, and with the physicist D. Coster, discovered the element hafnium.

Tracer Studies

In 1923, he applied the tracer technique to the determination of lead transport in the living plant. This was the first use of radioactive atoms in the study of biological processes. However, lead is not a particularly good element for such studies, and further advances in biological tracer techniques had to await new discoveries in other fields.

In 1926, De Hevesy was appointed Professor of Physical Chemistry at Freiburg, his old university, and served there for eight years. In 1930 he held the appointment as Baker Lecturer at Cornell University. He returned to Copenhagen in 1934, and since 1943 he has been associated with the Research Institute for Organic Chemistry at the University of Stockholm. In 1934, with Harold Urey's gift of heavy water, De Hevesy carried out tracer experiments on water exchange between goldfish and their surroundings. This was the first use of a stable isotope as a tracer in biology.

With the discovery of artificial radioactivity by the Joliot-Curies, De Hevesy was attracted again to biological studies, beginning with the structural dynamics of the human skeleton using radioactive phosphorus as a tracer. The studies were extended to include the phosphorous-bearing compounds in brain tissue, in the blood, and in cancerous tissue, as well as in the complex nucleic acids which are involved in heredity-controllers in the animal cell. These pioneering experiments lead to a wide application of tracer techniques in living organisms where the extremely minute amounts of radioactivity are harmless and where, until this technique

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**...no problem for the busy office building with a
HAUGHTON® 7-PROGRAM SYSTEM**

"Off peak two-way heavy" is one of *seven major traffic problems* that can tie a building in knots! It occurs at coffee break time—and between lunch-hour *up* and *down* peaks.

The Haughton 7-program system with Auto-Signumatic (operatorless) Control keeps a busy office building's elevators paced to traffic requirements at *all times*—solves those seven major traffic problems!

Take "off peak two-way heavy" traffic for example. Here's how a Haughton 7-Program System keeps tenants and visitors happy at this crucial time.

Up cars normally go all the way. If there is sufficient demand, unnecessary trips to top floors are eliminated. Up and down cars are dispatched ahead of schedule, if another car arrives at the same terminal, to reduce waiting time. Interval between cars is automatically adjusted to serve the heavier traffic.

No wonder buildings with Haughton 7-Program Service gain and maintain new prestige, greater desirability!

What's more, by eliminating the expense of training, outfitting and employing operators, the System can pay for itself. Continuing lower repair and upkeep costs are an extra "bonus!"

Our representative near you offers specialized help in solving your vertical transportation problems. Consult him without obligation on your part... or write Haughton Elevator Company, Toledo 9, Ohio.



4-PROGRAM SYSTEMS

Offer the same excellent service in installations of four cars or less!

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for detailed information and specifications, covering Haughton passenger and freight elevators, dumbwaiters and controls.

HAUGHTON Elevator Company

DIVISION OF TOLEDO SCALE CORPORATION

Executive Offices and Plant, Toledo 9, Ohio. Factory Branches Coast to Coast to serve you 24 hours a day. Complete Design, Engineering, Manufacturing and Installation Service.

QUESTION:

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ANSWER:

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SOUTHWESTERN PLASTIC PIPE possesses certain characteristics which are of particular interest to engineers:

- NON-AGING—no physical deterioration
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- FULL RANGE OF SIZES— $\frac{1}{4}$ " through 12" diameters

SOUTHWESTERN PLASTIC PIPE has been proven in these and many other applications:

- Conduit for electrical and communication lines
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With SOUTHWESTERN, you deal with a pioneer in the industry, backed by more than 50 years' experience in making pipe.

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was devised, it was believed that no direct studies could be made.

Activation Analysis

In 1935, in connection with a problem of chemical analysis, De Hevesy irradiated a sample of mineral salt with slow neutrons, knowing that the impurity would become radioactive and could be determined by measurement of the radiation. This was the first use of activation analysis, a technique used widely in biology and medicine in succeeding years with great success.

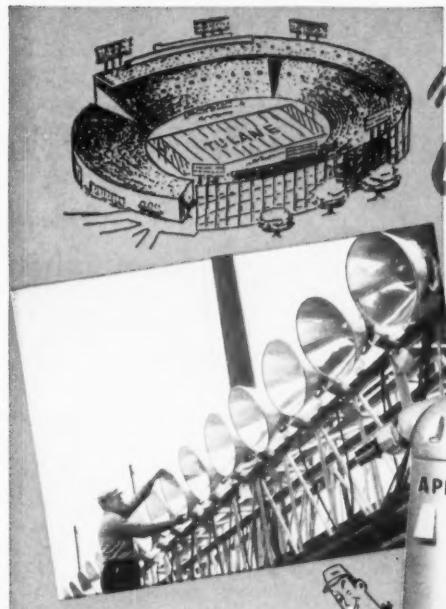
De Hevesy was awarded the Nobel Prize in Chemistry for 1943, in recognition of his contributions. In addition to his numerous publications in scientific journals, he has been author or coauthor of four books on radioactive techniques. He has been awarded the Copley Medal of the Royal Society in London (1949), the Cannizzaro Prize of the Academy of Sciences in Rome, the Faraday Medal (1950), and the Bailey Medal (1951).

Today, his enthusiasm for his work and his output of original contributions is undiminished. The list of new papers since 1950 of which he is author or coauthor contains over 50 titles dealing with problems in blood chemistry, iron metabolism, and radiation effects in biochemistry.

On the occasion of the presentation of the Atoms for Peace Award to De Hevesy, Glenn T. Seaborg related an interesting anecdote. De Hevesy once lived in a boarding house where the food was suspect, and there was much grumbling among his fellow boarders. It was believed that the leavings on the individual plates of the boarders ended up in a rather frequent hash. De Hevesy set out to establish the validity of these suspicions. One day he placed a tiny amount of radioactive material in a small scrap of meat he left on his plate. The next day he appeared at the boarding house with a Geiger counter, and when the hash was served the insistent click of the counter settled the matter. De Hevesy changed his boarding house.

Fitting Tribute

Glenn Seaborg had this to say about De Hevesy: "Few living scientists have partaken of the joys of science to the extent that Professor de Hevesy has. He has known to the full the nagging spur of curiosity, the thrill of adventure and the unexpected, and the sweet joy of defeat turned into victory. And few men can claim more the right to satisfaction in achievement—in the expansion of human knowledge and in the immeasurable and enduring benefits of his work for mankind. The Atoms for Peace Award would seem to have been designed especially to fit the life and the work of Professor George de Hevesy."



Workman at Sugar Bowl
checking INTENSO light
before bank is raised to
tower height.

Photos courtesy of
Tulane University

Mario Zervigon and Associates,
Consulting Engineers

Opens for Split-Second
Rear Relamping



Outstanding Features of APPLETON INTENSO FLOODLIGHTS

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■ Unlighted for 30 years, the choice of lighting experts, maintenance and financial men at Tulane for illuminating the Sugar Bowl was APPLETON INTENSO Floodlights! Because only APPLETON-engineered INTENSO provides the accurately planned high intensity illumination, ease of servicing, cleaning, re-lamping, and positioning that gives maximum trouble-free, year-round lighting. Write for full information on the complete line of APPLETON Alzak Aluminum Floodlights!

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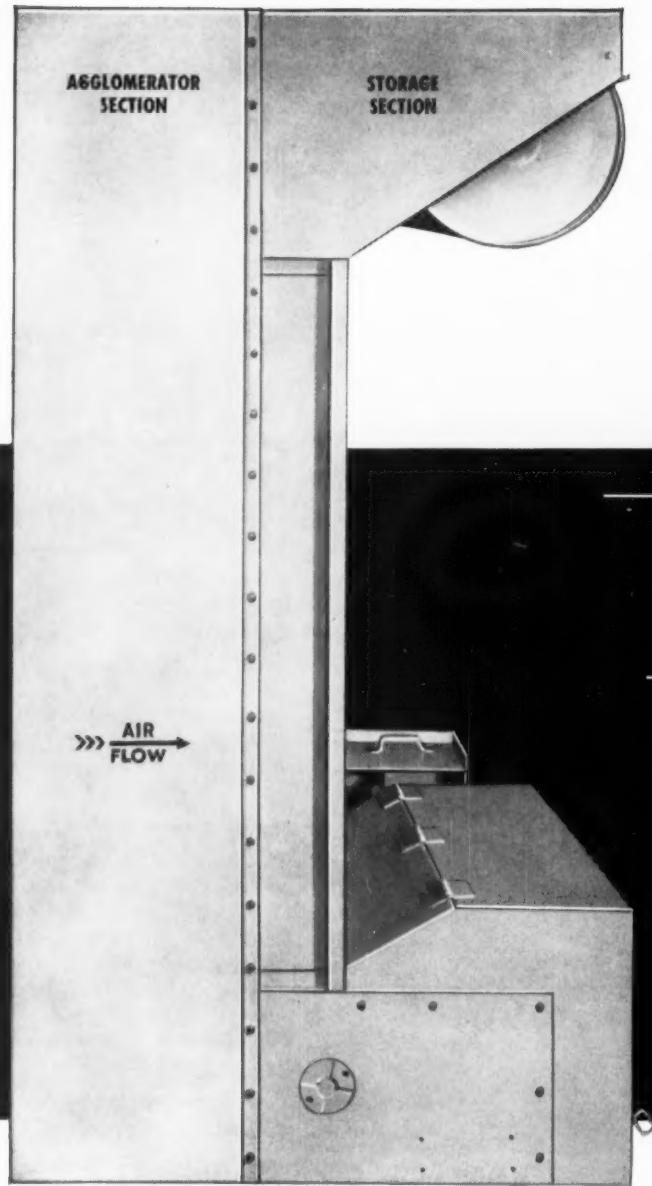
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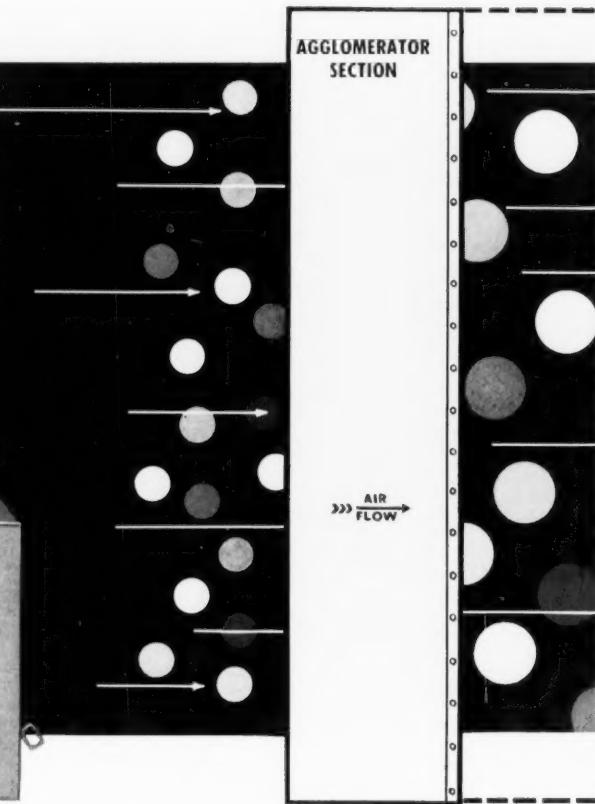


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■ no water ■ no washing



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both in one space-saving unit!

This revolutionary new air cleaner is the Rollotron. Its unique operating principle is shown in the exploded "flow diagram" illustration.

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I TRAP THE DUST ELECTRONICALLY!

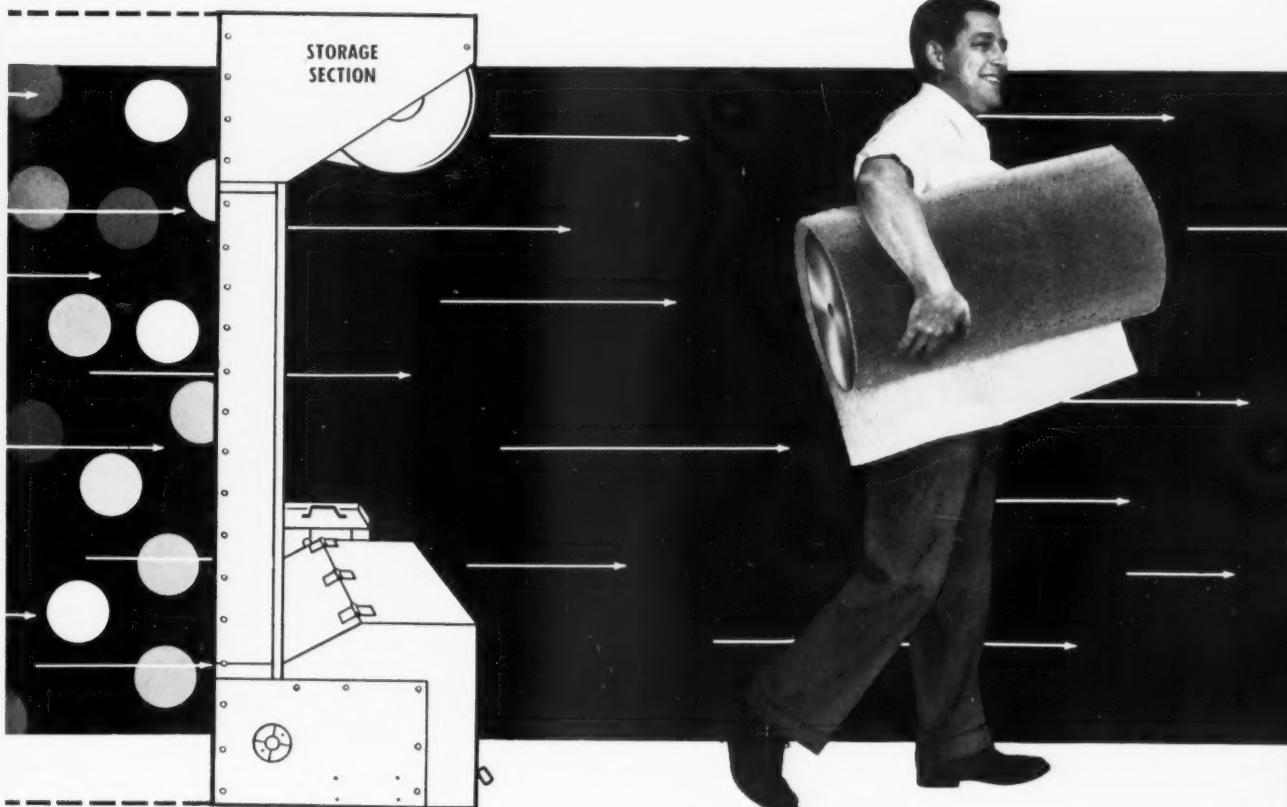
Minute dust particles are electrostatically attracted and adhere to each other on the dry plates of the agglomerator section. As the trapped dust particles build up (agglomerate) on the collector plates, the "mass" increases until the accumulation is swept off the plates by the air stream. Dirt is then carried onto the bonded glass fiber media of the storage section.

Maintenance on precipitator section? Virtually none. No oiling, no washing, no water, no freezing, no drains.

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electronically, rolls away the dirt!

■ no freezing problems ■ no drains ■ no oiling of plates



2 ROLL IT UP AUTOMATICALLY!

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Maintenance? Simply replace the soiled roll with a clean one—an operation as simple as changing the film in your camera! In normal service, this is required only about once a year! The Rollotron makes scheduled maintenance a thing of the past!

3 TAKE IT AWAY PERIODICALLY!

With quick, easy media replacement, the Rollotron is again ready to give maximum air cleaning—electrostatic air cleaning—for months to come!

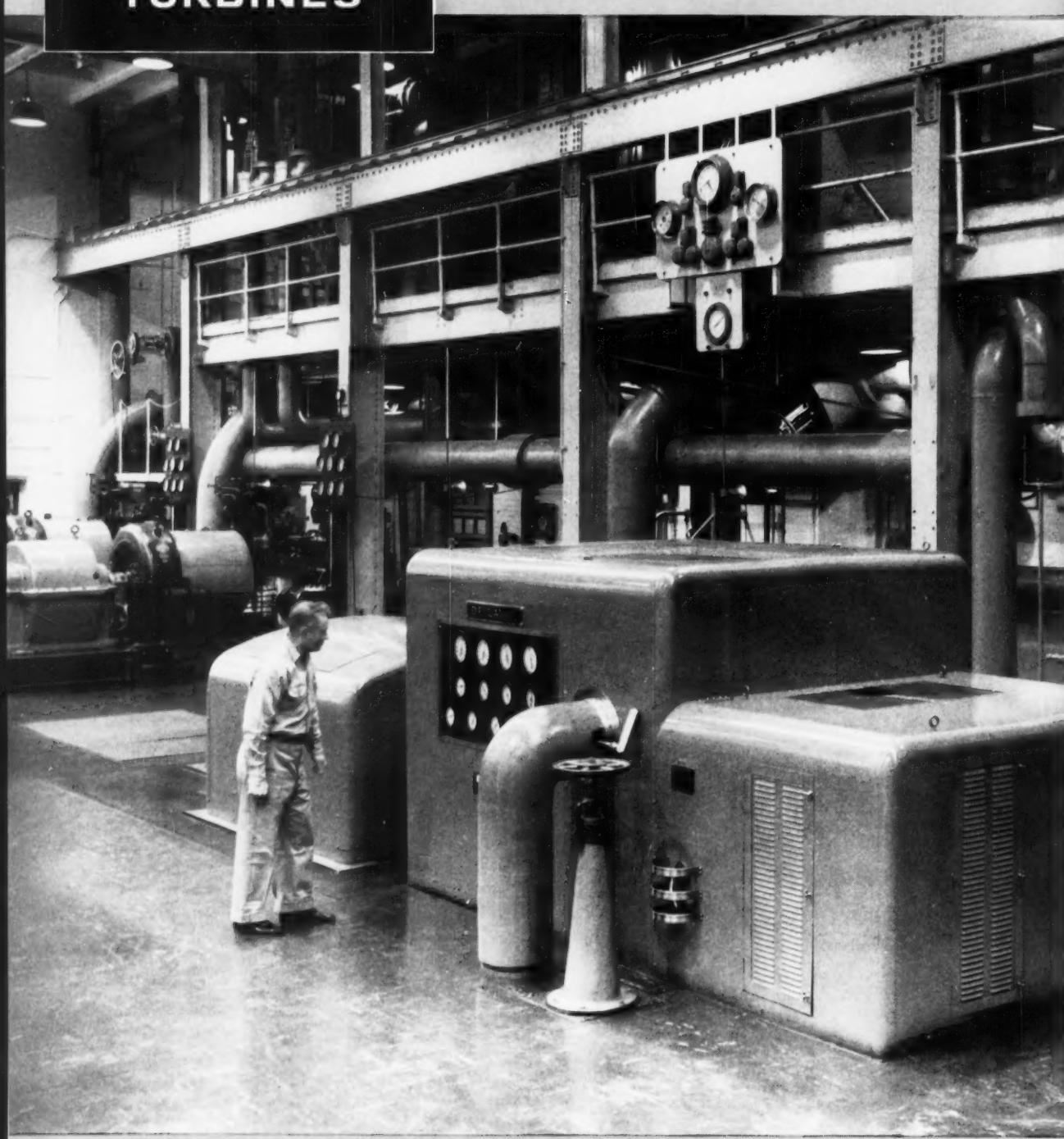
For complete information on "electronically clean air by the roll" see your local AAF representative or write for Rollotron Bulletin 249. Address: Mr. Robert Moore, American Air Filter Company, Inc., 300 Central Avenue, Louisville, Kentucky.



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BETTER AIR IS OUR BUSINESS

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STEAM
TURBINES**

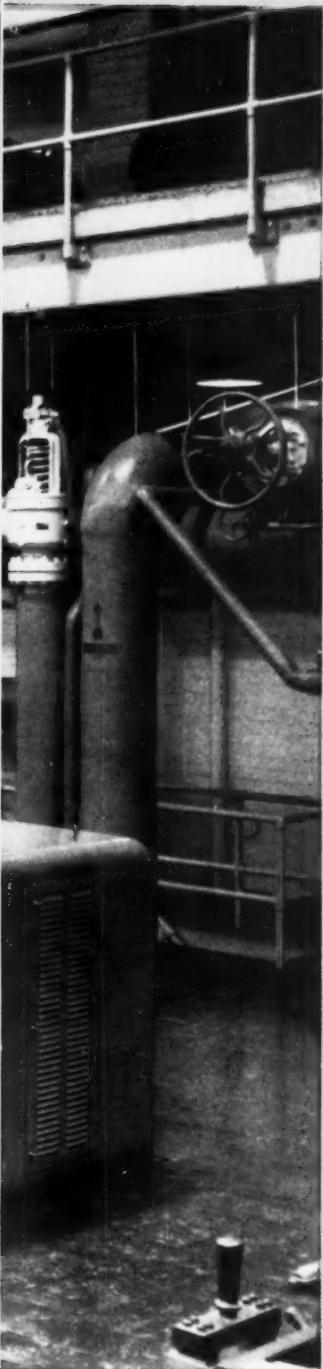
for process industries



The photograph above shows a De Laval direct-connected turbine generator installation at Parke, Davis & Co., Detroit, Michigan.

PL5489

This controlled extraction, controlled back-pressure unit supplies 5000 kw using process steam. Extraction is at 130 psig, exhaust is 5 psig. This new machine was added to already existing De Laval units that have been in service for 30 years. In addition, the Parke-Davis Research Laboratories in Ann Arbor, Michigan will soon be using a new 1000 kw unit.



Parke, Davis & Co. uses **DE LAVAL Steam Turbines for process and power generation**

Proved economy, dependable service

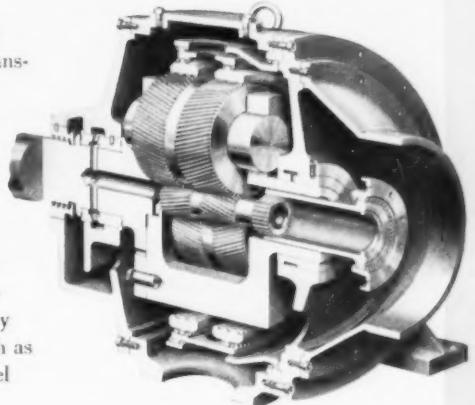
In many process industries, an important by-product is economical electric power. If appreciable quantities of process steam are used, power generation can be achieved at comparatively low cost.

De Laval, pioneer in high speed rotating machinery, has continued to maintain engineering and manufacturing leadership. If you have process application where low-cost power generation can be utilized, call on De Laval.

De Laval-Stoeckicht Planetary Gears

In many applications where high speed and high horsepower are transmitted, the De Laval-Stoeckicht planetary gear can be used to great advantage. It is also used as a speed increaser or decreaser in many industrial installations.

Among its outstanding characteristics are light weight, in-line construction and space saving. It may be used for all kinds of drives such as gas turbines, steam turbines, diesel engines, etc.



Write for Bulletin 2400



DE LAVAL *Steam Turbine Company*

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The Word From Washington

EDGAR A. POE

Consulting Engineer Correspondent

THE BIGGEST construction program of all time, the Interstate Highway program, is facing a mighty road block. The Highway Trust Fund is running out of money and will be in the red by \$923 million by 1960, \$5 billion by 1963.

Congress has apparently turned thumbs down on the additional 1½ cents a gallon gasoline tax recommended by President Eisenhower. The various states are advising Congress that the gasoline tax is one of the few easily collected imposts still open to them, and they are urging Congress not to increase the Federal tax.

Congress still is shooting for completion of the 41,000-mile system within the 13-year authorization period and 15-year construction period. Despite the prospects of a slowdown, chances are Congress will find some way to keep the vast program going.

Alaska Highway Proposal

A measure calling for paving of the 1200-mile Canadian portion of the Alaska Highway is pending before the Senate Public Works Committee. The bill, authored by Senator Richard L. Neuberger, of Oregon,

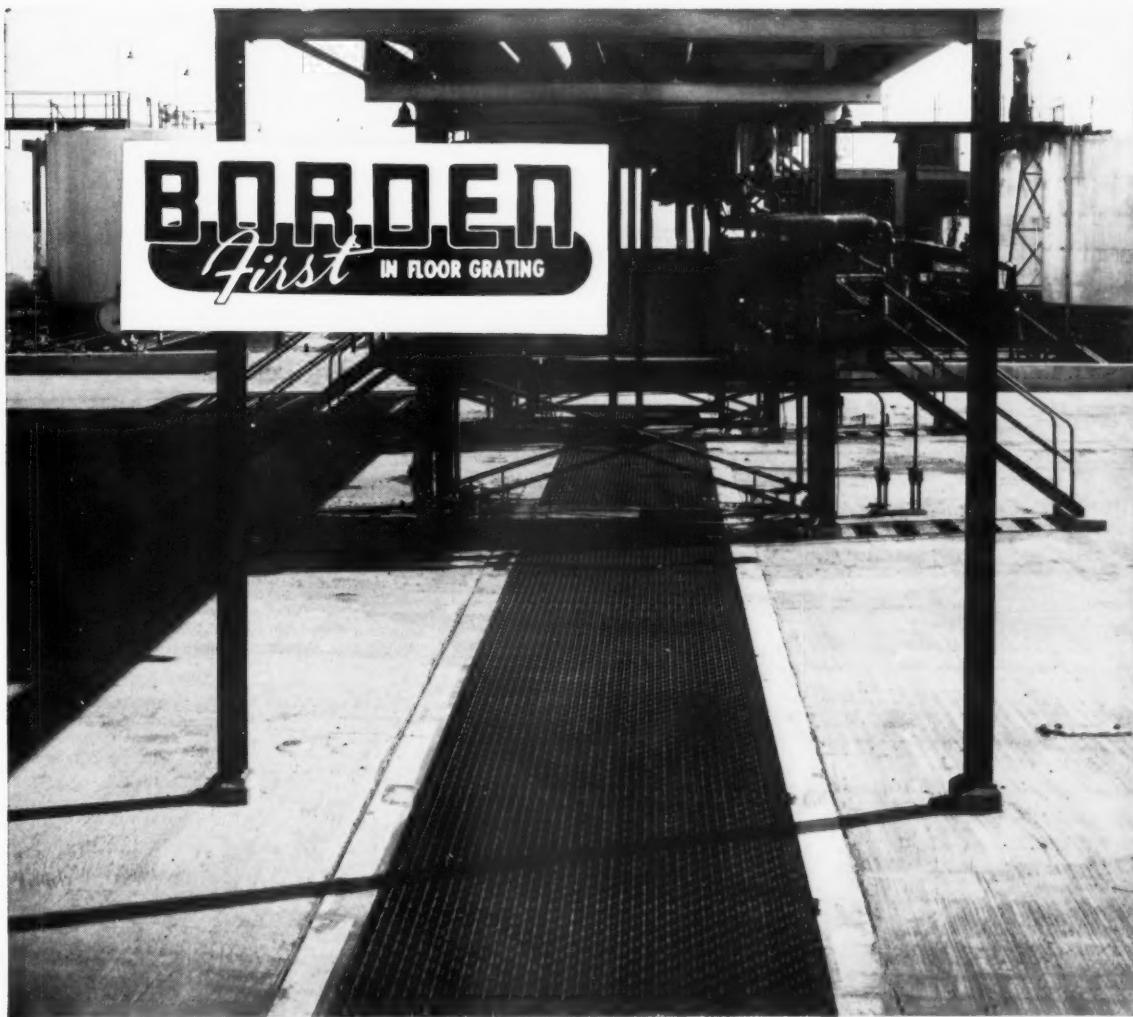
would provide for United States-Canada engineering and planning, with construction costs shared on a 50:50 basis. This would involve U.S. expenditures of \$11 million per year for six years, since BPR estimates the total cost at \$125 million. Canada would permit United States traffic to use the highway on a toll-free, tax-free basis, and would be responsible for year-round maintenance. Currently the 1200 miles of the highway in Canada are gravel, and only 300 miles are hard-surfaced in Alaska.

Foreign Aid . . .

President Eisenhower is standing firmly behind his \$3.9-billion foreign aid program. Declaring that foreign assistance to raise standards of living is more vital than ever before, the President has indicated that he will use his veto as a weapon to get funds he regards as extremely important to our welfare.

. . . and Investment

There is increasing interest in the "Encourage American Investment Abroad" bill of Rep. Hale Boggs, member of the House Ways and



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Means Committee. Business, professional, and trade organizations all over the country are inviting him to speak on the measure. His mail on the subject has been brisk. A special class of domestic corporation, known as a foreign business corporation, to conduct the foreign operations of American firms would be established under the Boggs proposal. The foreign business corporation would enjoy the privilege of deferral of U.S.

taxes on its income. "This bill represents," said Boggs, "a balanced and moderate proposal for tax reform in the field of foreign source income that will go a long way in providing incentives necessary to promote the expansion of private foreign investment."

Retirement Bill

Representative Eugene J. Keogh, Democrat of New York, the prime mover behind the self-employed

retirement bill, predicts that Congress will enact the measure this summer, certainly before it adjourns. The proposal, which passed the House in 1958 but hit a snag in the Senate, would permit consulting engineers and other self-employed professional and business men, to deduct from taxable income up to 10 percent of their annual earnings for deposit in a retirement fund. It would allow deductions up to \$2500 a year to a total of \$50,000.

Water Supply Problem

The Bureau of Mines, through Director Marling J. Ankeny, has issued a fresh warning about the nation's water supply. Said Mr. Ankeny, "Forecasts of the nation's water requirements for the next 25 years indicate that perhaps twice the present quantity may be required. Providing adequate supplies for this expansion will require major efforts by private and government organizations, not only in constructing new dams, reservoirs, and distribution systems, but also in conserving and reusing water supplies and controlling pollution.

Power Reactor Program

Senator Albert Gore obviously sought to give John A. McCone, Chairman of the Atomic Energy Commission, rough legislative sledding when he appeared before the Joint Atomic Energy Committee of Congress, but McCone held his own. Senator Gore pointed out that former AEC Chairman Lewis L. Strauss had said, in 1955, that the greatest advances in reactor technology would come from actual construction and operation of large scale reactors on a commercial basis — that there was no substitute for practical experience.

"I agree with that statement. Do you?" Senator Gore asked McCone. "No sir, I do not agree with that statement," was McCone's reply. "I do not think that the most rapid approach to economical nuclear power results from the building of

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large, central stations at this time, which obviously must be of limited efficiency . . . I think we can advance the technology much better, much cheaper, and much faster by building modest size prototypes."

Representative Chet Holifield, Democrat of California, said he would like for the record to show that there is "a possibility for the public power people to participate in this type of program because it is well known that public power

people have no reserves for capital investment in a plant." Whereupon, Senator Gore snapped: "The Atomic Energy Commission is going to give it to them."

Representative Craig Hosmer, Republican of California, disagreed with his colleague, asserting that public power groups, such as municipal utilities, do have capital to build their own prototype plants. McCone agreed. He added that these plants could be large enough

to demonstrate on a commercial scale the economic feasibility of the designs.

"The public utility groups, under their charter," said Chairman McCone, "can invest in plants, and have funds to invest in plants that approach the cost of conventional plants. Some tell me they can go past that under their charter, which permits research and development that might lead to improvements in their system."

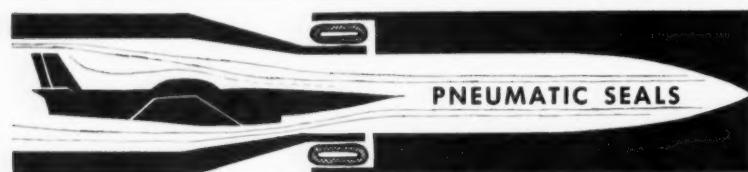
The National Coal Association said proposed Federal subsidies for atomic power plants would "use the United States Treasury to drive the bituminous coal industry out of its best market." The NCA emphatically insists that the Government should not subsidize domestic electric power production from atomic energy beyond the research and development stage.

Senator Clinton P. Anderson, chairman of the Joint Committee on Atomic Energy, introduced the Atomic Energy Commission's pending bill calling for only \$115.5 million to finance construction for fiscal 1960. AEC had \$386 million authorized for the current year, \$259 million for 1958, and \$319 million for 1957.

Tidal Power

Funds to complete a three-year, economic feasibility study by the International Joint Commission in connection with a tidal power project at Passamaquoddy Bay, between Maine and Canada's New Brunswick Province, appear assured. The survey (\$616,000 was appropriated for fiscal 1959) will determine the cost of construction, cost of hydroelectric power generated by the proposed project, and what the project would contribute to the national economy and defense.

The U.S. Army Corps of Engineers is inquiring into power construction and location requirements. The Federal Power Commission, with the assistance of the Army Engineers, is studying the potential power market and trans-



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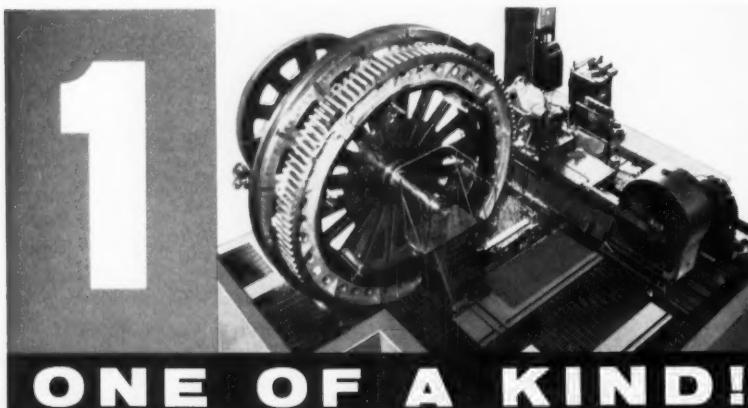
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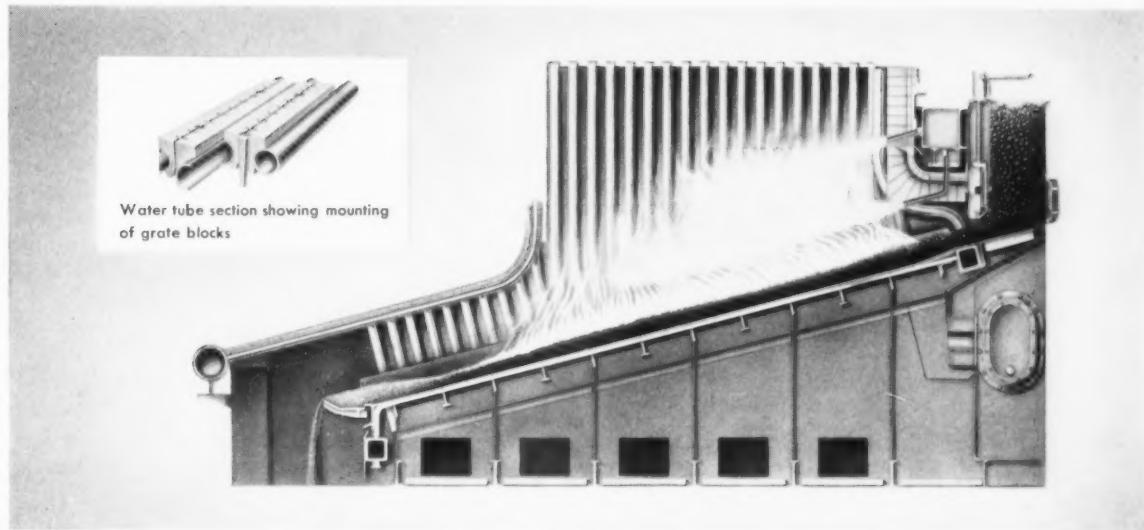
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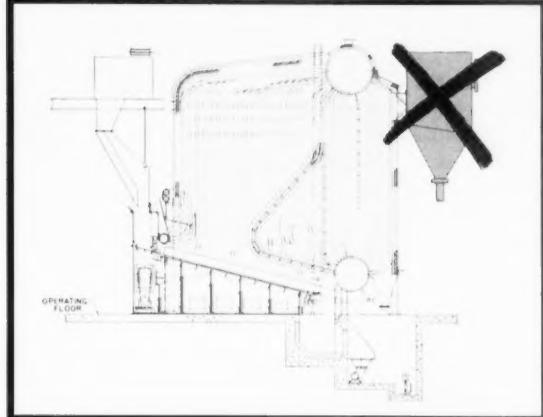
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mission problems. Should the engineers recommend it as feasible, this potentially huge project probably would stir up a storm on Capitol Hill among the public power versus private power advocates in Congress. A Passamaquoddy tidal power plant project was started back in the 30's, it will be recalled, but was abandoned. It was a political as well as an engineering problem in those days, too.

Photogrammetry

The Bureau of Public Roads, in its *Journal of Highway Research*, published an article designed to show that airphoto interpretation techniques are useful for highway engineering terrain studies in wilderness areas. The article, written jointly by Ernest G. Stoeckeler of the University of Maine and William R. Gorrell of the Maine State Highway Department, states that time-consuming and expensive field reconnaissance surveys were re-

duced to a minimum in Maine by "intelligent use" of aerial photography. Detailed field investigation and laboratory testing still are required to obtain information for final design purposes.

NASA Funds Needs Rising

Congress has before it a warning from the National Aeronautics and Space Administration that the current budget recommending \$500 million may be small compared with what it expects to ask from Congress in the next few years. Dr. T. Keith Glennan, NASA chief, states "We are making the down payment on progress that eventually will cost very much more in the years ahead. Before we have completed this first U.S. effort to put man into space, the bill will have exceeded \$200 million."

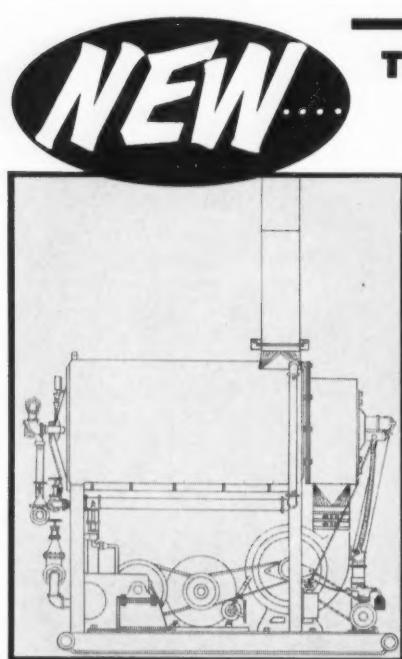
Reclamation Projects

More than 170 active construction projects with a total face value of \$340 million are in progress under

supervision of the Bureau of Reclamation. Included are 14 storage dams, one diversion dam, two power plants, 19 pumping plants, 100 miles of main canal, 200 miles of laterals and pipelines, and 480 miles of high voltage power transmission lines. Contracts also are being let on five storage dams — all earthfill structures.

Civil Defense Cutback

Lack of interest by the public toward bomb shelters may result in sharp reductions in the Government's \$100 million a year civil defense program. A substantial portion of the money has been devoted to paying salaries to people who do little or nothing. The Berlin crisis could spur renewed interest in bomb shelters, but some members of Congress maintain that it is unreasonable to advocate that citizens build bomb shelters while at the same time they are told the cold war may last another three or four decades. ▲▲



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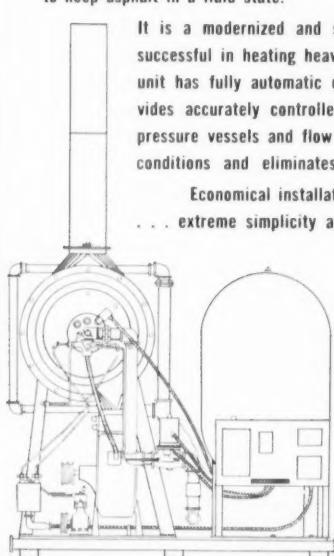
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Economical installation, maintenance and operation . . . utmost safety . . . extreme simplicity are added advantages of the new 25-A Texheater.

Standard units are available with output capacities of 300,000 to 2.5 million BTU's per hour. They can be fired with natural gas, propane, kerosene, diesel oil and regular fuel oils.

Increase the efficiency and lower the cost of keeping asphalt fluid by using the Texsteam 25-A heater.



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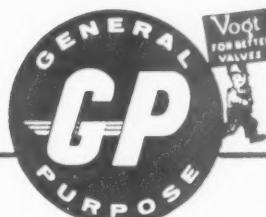
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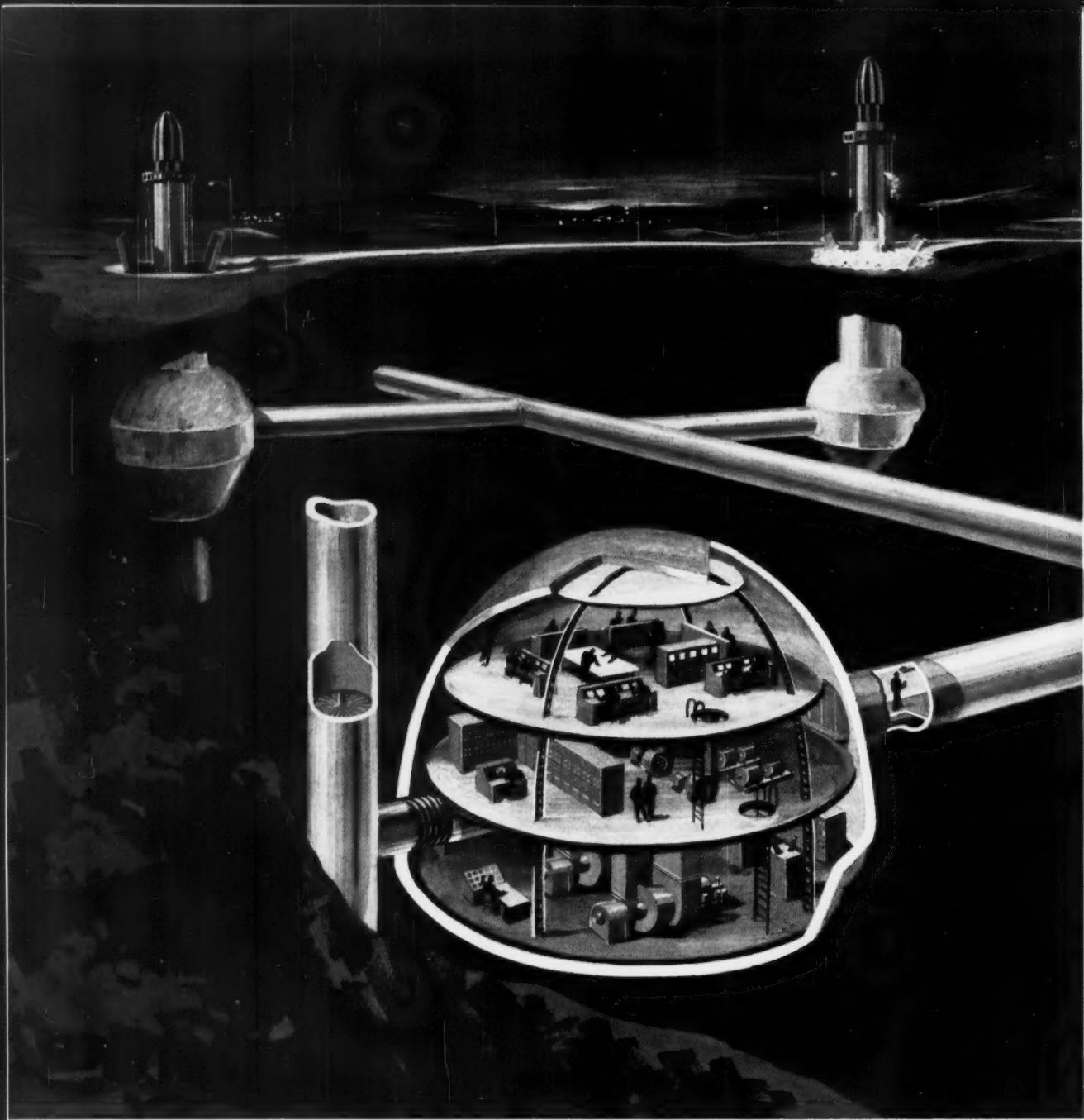
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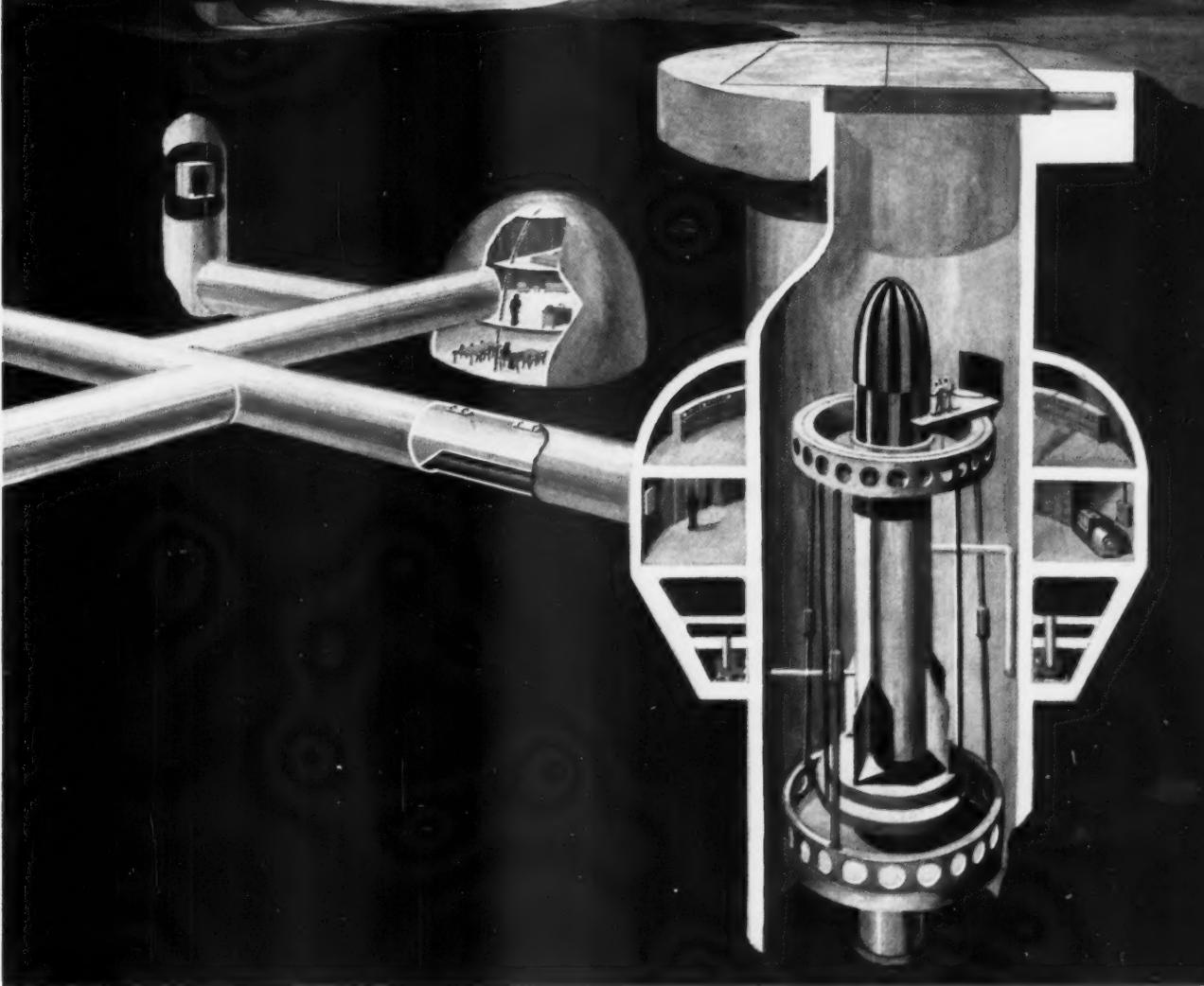
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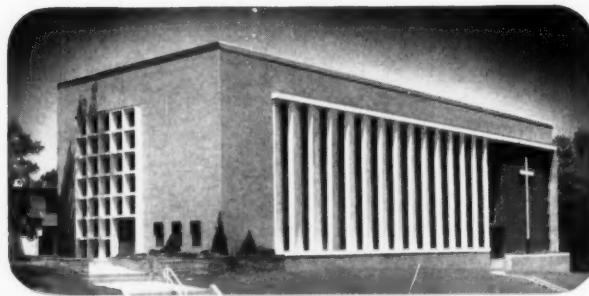
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News for the Consultant

British Association's Annual Dinner

More than 400 members and guests attended the annual dinner of the British Association of Consulting Engineers at the Dorchester Hotel, London, this year. Principal speaker was J. K. Vaughan-Morgan, Minister of State at the Board of Trade, whose talk dealt mainly with the work of British consulting engineers and the construction industries overseas.

He pointed out that the greatest obstacle to work in underdeveloped countries was lack of capital, but that the British government was trying to make more money available for Commonwealth development and Welfare Acts, through the expansion of the Commonwealth Development Finance Company and loans through the Export Guarantees Acts. However, Mr. Vaughan-Morgan said, the largest source of finance in underdeveloped areas is the World Bank, which already has loaned \$3.7 billion, and new loans approved last year amounted to \$710 million.

"Of course, when we are dealing with the International Bank we are in direct competition with the constructional industries of other countries, but we do what we can to see that they know of the achievements and qualifications of British firms and also that British firms know as early as possible of new projects."

Increased resources for development also would make it possible for British consulting engineers to add to their long list of work overseas, according to Mr. Vaughan-Morgan. The work for which they were responsible in 1958 amounted to \$1.17 billion, compared with \$1.075 billion in 1957. On his tours overseas, Mr. Vaughan-Morgan said he had seen evidence of the great contributions made by British consulting engineers — directly by providing a demand for British manufactured goods, but also by the advertisement of their examples of English skill. "The work of the consulting engineer is surely the key if we are to unlock the hidden resources of the underdeveloped areas of the world. Let me hope, then, that your work will continue to expand for that reason, not only because it adds to our



prestige but also because it contributes so greatly to the prosperity of this country."

Mr. Vaughan-Morgan mentioned that the Middle East, despite its serious political unrest, continues to grow each year in importance as a market for the United Kingdom.

Responding to the toast, J. T. Calvert, Chairman of the Association of Consulting Engineers, raised the question of advertising by the British contracting industry and said: "The modern approach to engineering construction recognizes that the contractor and the consultant each have their functions which can be properly exercised without being at loggerheads and without an overdose of mutual suspicion. Nevertheless, some of our members are a little disturbed at the increasing tendency for contractors to undertake design work services and to adopt whatever sales techniques they think best. I must concede that most of these advertisements I have read have been fair, and have brought out the admitted advantages of this form of procedure. What we do contend is that there is another side to the argument — that independent design by introducing more competition at the bidding stage results in a better and more economical end product. Carried a stage further, we maintain that the turn-key bid which includes design and construction is contrary to the best interests of the client because at the bid stage it duplicates design work, all of which has to be paid for, because the assessment of the relative merits of different bids is virtually impossible without a consulting engineer and because the difficulties of supervision during construction are considerably increased."

CEC's Third Annual Meeting

The Consulting Engineers Council will hold its third Annual General Meeting April 28 through May 3 at the Biltmore Hotel in New York City. Some 200 delegates and members representing the Council's 21 state and regional affiliates are ex-

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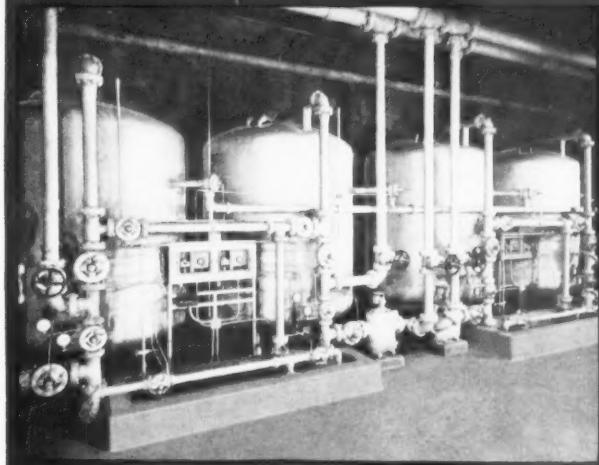


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Illustrated above is a huge 84" Duct Fan . . . one of 24 built by Aerovent for The Consolidated Edison Company for installation in its Arthur Kill and Astoria Generating Stations. These fans, with 20 H.P. motors turning 580 RPM, move air against resistance at the rate of 100,000 CFM. Other Aerovent units are available in sizes from 12" to 96" for capacities to 145,000 CFM.

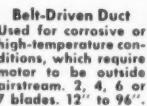
Aerovent Duct Fans . . . direct-driven for standard applications or belt-driven for conditions requiring motor outside airstream . . . may be ordered with special duty motors, alloy propellers and special protective coatings for extreme temperature, moisture or corrosive conditions.

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For installations which permit connection of entire fan assembly in air-stream. For vertical or horizontal use. 12" to 96".



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Used for corrosive or high-temperature conditions, which require motor to be outside airstream. 2, 4, 6 or 7 blades. 12" to 96".



"Bi-Flo" Duct
For pressures in the 1½" to 4½" range. New 7-blade "Machete" Airfoil Propellers move more air with lower horsepower. 18" to 48".

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pected to attend, with the New York City and New York State Associations of Consulting Engineers acting as co-hosts.

Julian S. Tritton, of London, president of the International Federation of Consulting Engineers (FIDIC), will address the convention at the Installation Banquet on May 1.

Among the important items of business are the election of new officers and adoption of standard forms of contract to be published by CEC for use by members, a large-scale public relations program to promote the profession, and a group medical insurance program for CEC members, employees, and families. Up for discussion will be the proposed "Guide to the Practice of Consulting Engineering," which summarizes studies now being completed relating to office practice, fees and contracts, ethics, employee relations, and minimum standards.

G. Fox & Co. Expansion

Construction has begun to more than double the size of one of the nation's largest and most modern department stores, G. Fox & Co. of Hartford, Connecticut. The \$8-million expansion project calls for the addition of 528,000 square feet of selling space



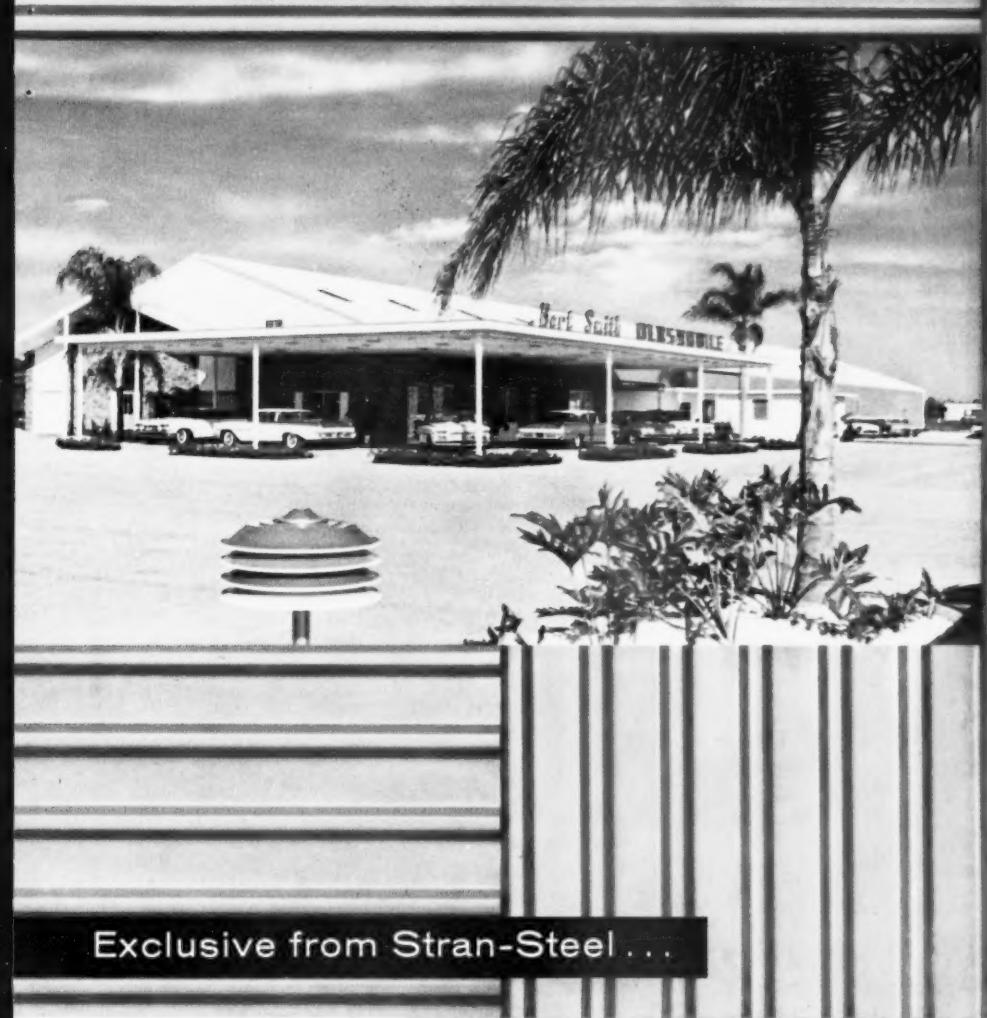
Additions to Hartford's G. Fox department store will border the city's redeveloped downtown area.

and service and warehouse facilities to be attached to the present store in the downtown area.

Abbott, Merkt & Company and Ebner Associates (formerly The Firm of Edward E. Ashley, Consulting Engineers) are the architect-engineers on the project. Turner Construction Co., the contractor, expects to complete the job by the spring of 1961.

\$315-Million Urban Redevelopment Project

Some 5000 old buildings will be razed in the Bunker Hill area of Los Angeles to make room for the nation's largest urban redevelopment. Plans for the \$315-million project include a 24-acre residential



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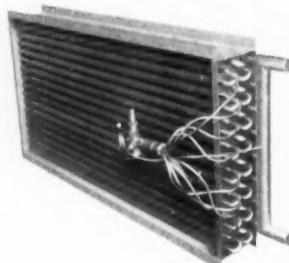
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plaza containing 3100 apartments, a 16-acre plaza for business offices, a 14-acre motel section, a 6-acre hotel site, and shopping facilities. Parking for 10,000 cars will be provided in both above and below ground garages.

Charles Luckman Associates, Los Angeles, is the supervising architect-engineer for the project; The Donald R. Warren Co. is the consulting engineer; and William L. Pereira is associated architect.

West German Nuclear Power Program

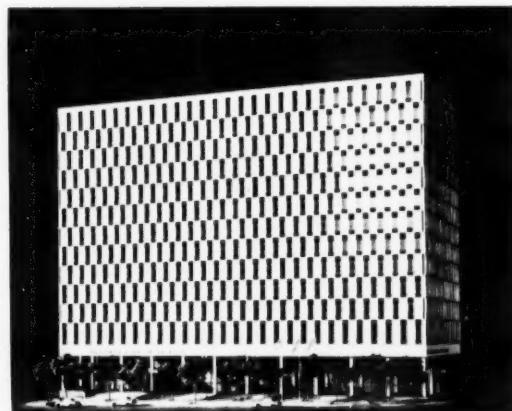
West Germany is rapidly becoming one of the world's powers in peaceful exploitation of the atom. Late last year, a 5000-kw nuclear reactor and research facility for marine reactor applications was dedicated near Hamburg. The pool type reactor, designed by Babcock & Wilcox Company and operated by The Society for the Utilization of Nuclear Energy in Shipbuilding and Navigation, Inc., is the largest of its type ever built.

Work also is under way on \$40-million nuclear research establishment near the Belgian border. The West German government has bought two British reactors for this facility and is constructing a reactor of its own design. The German reactor will be of radical design—a 15,000-kw experimental plant with the barest minimum provisions for shielding and containment.

National Bank of Detroit Building

Downtown Detroit's first new commercial building in 20 years, the main office building of the National Bank of Detroit, is going up on schedule. The 14-story fully air conditioned curtain wall structure is slated for occupancy this summer.

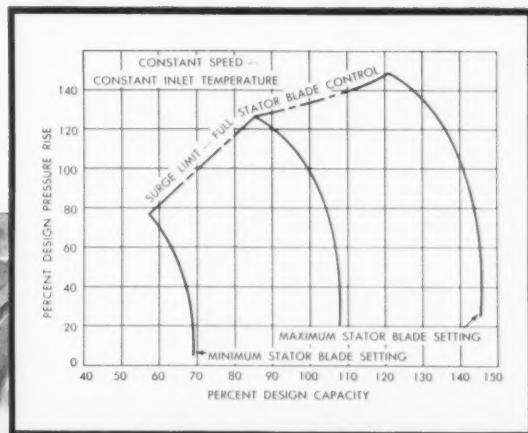
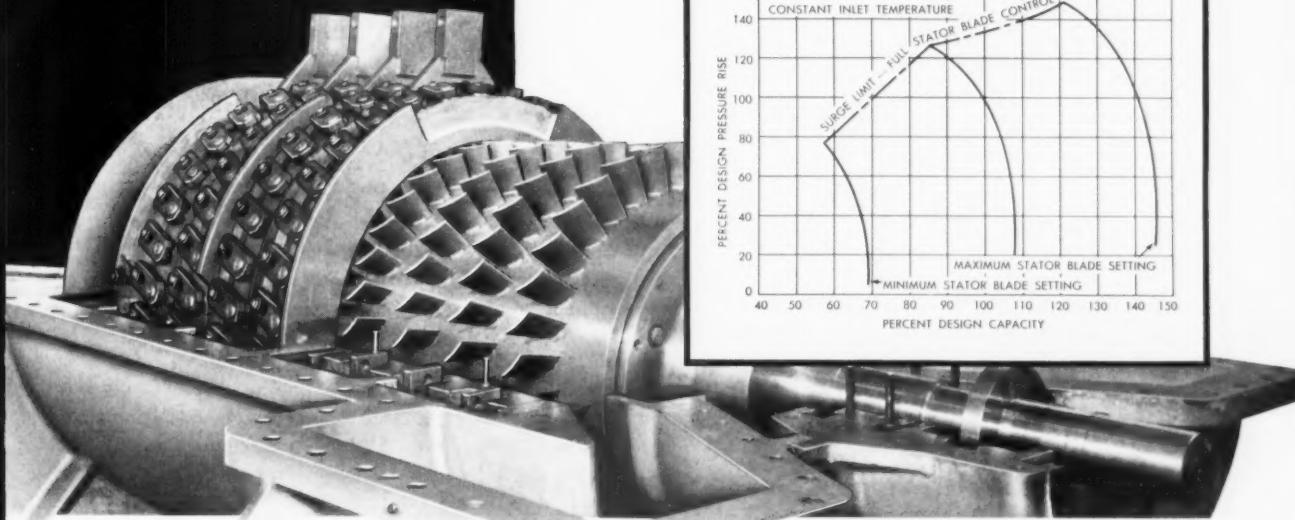
Albert Kahn Associated Architects and Engineers, Inc., faced a number of interesting mechanical and



Scale model of new bank in Detroit illustrates the alternate placement of marble panels and windows.



NEW Adjustable Stator Blade Axial Compressors



Get wide capacity range at high efficiency

WITH adjustable stator blade control, now available on Allis-Chalmers axial compressors, varying capacity needs can be met by merely changing stator blade settings — while the machine is in operation. Limited operating range need no longer be a problem.

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These additional advantages are inherent in axial compressor performance:

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structural design problems in this building that is solely for banking purposes. Six vaults, one 140 feet x 58 feet, had to be included — with a total of 14 vault doors. Each of the doors alone weighs 12 tons. Another requirement was that the complete sidewalk area surrounding the building would be kept free of snow or ice; a radiant heating system was specified for under-the-sidewalk installation. Provisions also had to be made for a heliport atop the setback penthouse comprising the two top floors of the building. The penthouse encloses air conditioning equipment and the machinery serving the structure's 16 elevators.

Feasibility Study

Parsons, Brinckerhoff, Hall and Macdonald, New York engineering firm, has told the North Carolina State Highway Commission that toll bridges crossing the Cape Fear River at Wilmington and the Alligator River between Tyrrell and Dare counties are not economically feasible. The study fixed the price of the Cape Fear project at over \$16 million, and the Alligator bridge at over \$7 million. Reasonable tolls based on anticipated traffic would bring in only about 10 percent of the money required to finance the bridge projects through the sale of revenue bonds.

The consulting firm also studied the feasibility of a tunnel crossing at Wilmington, but found it to be even less economically feasible as a self-liquidating project. The tunnel was found to cost \$25 million, and toll revenues would not be sufficient to cover maintenance and operating expenses.

Ninth Longest Steel Arch for Pakistan

Plans and specifications by D. B. Steinman, New York consulting engineer, are complete for a new railroad bridge to cross the Rohri Channel of the Indus River near Sukkur in West Pakistan. The steel trussed arch will have an 806-ft 9-in. span between end pins of the bottom rib, making it the ninth longest steel arch in the world. The rise of the bottom rib is 180 feet and the distance between ribs at the crown is 24 feet, giving the bridge a total height of 204 feet.

The design calls for E55 loading on a single broad gage (5-ft 6-in.) track. The over-all bridge floor will be a concrete deck, 15-ft wide between curbs and centered on the track centerline, for possible use by Class 80 military vehicles.

The Sukkur Arch will be erected 100 feet downstream from the 70-year old Lansdowne railway bridge it will replace. The Lansdowne bridge is a cantilever, with an 820-ft main span, and will be converted to highway use after the new arch is completed. Sir Alexander Rendel, one of the early senior partners in the London firm of Rendel, Pal-



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Artist's conception of the new Indus River railroad bridge. It is an 806-ft 9-in. steel trussed arch.

mer and Tritton, originally designed the Lansdowne span as a combination highway and railway bridge. It later became a railway and pedestrian bridge.

New Station for New England Electric

Stone & Webster Engineering Corporation will design and supervise construction of a new 225,000-kw power station in Somerset, Massachusetts for the New England Electric System. Engineering work on Unit No. 1, to be located at Brayton Point on the Lee River, is already under way. Project engineer at Somerset is W. E. Hopkins.

Engineering Training Program in Scotland

A group of Scottish electrical manufacturers and government organizations have formed a cooperative educational program, the Scottish Electrical Training Scheme, to recruit and train university graduates for the Scottish electrical industry. SETS also encourages graduates, leaving the country in increasing numbers, to remain in Scotland.

Charter members of the organization include The Belmos Co., Ltd.; Bruce Peebles and Co., Ltd.; The Harland Engineering Co., Ltd.; Honeywell Controls, Ltd.; the North of Scotland Hydroelectric Board; Scottish Cables, Ltd.; and the South of Scotland Board.

SETS trains electrical engineering graduates and those with equivalent diplomas for the two years necessary for the Graduateship of the Institution of Electrical Engineers. The trainee spends the first year securing board training with several of the member firms; in the second year, he selects one firm for specialized training. At the end of the second year, the graduate is ready to assume a responsible job with the company of his choice.

The training program stresses managerial problems as well as technical problems. Each graduate of SETS is considered a potential manager.

SETS also has taken secondary school students under its wing, arranging visits to interest students in an electrical engineering career. Although the two-year old organization has experienced typi-



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Available with horizontal or vertical air flow. Lowest silhouette. ► Kramer's UNICON is so quiet it can be used in unlimited multiples. ► No one can match Kramer's 20 years of accumulated know-how in air-cooled condensing and no other air-cooled condenser can match the Kramer UNICON—the pioneering leader in the industry.

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A PERMANENT Alnico magnet, located *outside* the float chamber, links boiler water level and electrical controls. This infallible magnetic link eliminates mechanical parts normally subject to wear and fatigue failure. *Pioneered and perfected by Magnetrol*, it provides almost unlimited operating life.

The brass "No-Scale" float chamber liner, another exclusive Magnetrol feature, is self-cleaning. It actually "flexes" off scale and prevents "sticking" of the float.

These are just two of *many* advances for greater boiler safety found *only* in Magnetrol. Standard Magnetrol units are available for temperatures up to 750°F., at pressures up to 600 psi, for single stage (low water cutoff) or multi-level stage (pump control plus low water cutoff and alarm) service with as many as three separate switching actions. Special units are available for more extreme requirements.

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cal growing pains, it is working out so well that it already is being copied as a pattern for other industries in Scotland.

John J. Kane Hospital

Careful design has resulted in an unusually comfortable and pleasant environment for the inmates of the 2088-bed John J. Kane Hospital, near Pittsburgh, for chronic cases and convalescents. According to Dr. Gerard P. Hammill, medical director, the \$22.5-million hospital was built expressly to be a departure from the old institutional concept in which the patient becomes a prisoner of his bed — staying there because he has no place to go.

In keeping with this concept of what a modern hospital should be, there are few stairways. In their place are gently sloped ramps, designed to



Main building of John J. Kane Hospital is at right. Pyramidal structure is interdenominational chapel.

be negotiated easily by the wheelchair-confined patient. The lower levels of the two-story infirmary buildings open directly to the area outside the hospital proper; second levels lead into the courtyard.

Cook & Zern were the structural engineers; Dzubay and Bedsole and Paul A. Edwards were the mechanical engineers, and E. T. Wiesman was the electrical engineer. Button & McLean and Mitchell & Ritchey were the architects.

Welded Steel Tubing

Consulting engineers are specifying increasing quantities of small diameter welded steel tubing. Because of its extremely high strength-to-weight ratio and because bending stresses are distributed equally in all directions, steel tubing is ideally suited for column sections. It is a particularly good material for long columns where changing stresses can cause materials with different cross sections to buckle under load.

A recent test conducted in Germany points to the superior characteristics of the tubular section for



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tower construction. Four towers were erected — two 20-ft high and two 40-ft high — to compare welded steel tubing design with riveted rolled angle sections. All towers were rigidly anchored to foundations. A horizontal force was applied to each of the towers until failure occurred. The 20-ft tubular tower withstood 107 percent more horizontal load than the angle iron tower of the same height; the 40-ft tubular tower withstood 66 percent greater load than the 40-ft angle iron structure.

Design and Construction in India

India's Planning Commission proposes to establish a central industrial design group and five construction agencies to help reduce the costs of industrial and developmental projects throughout India. The design coordinators will study the plans for all large scale construction jobs, and will suggest economical new building techniques, particularly with emphasis on saving of steel. The construction agencies will provide expert guidance on the application of new methods of construction with which private building contractors in India are unfamiliar.

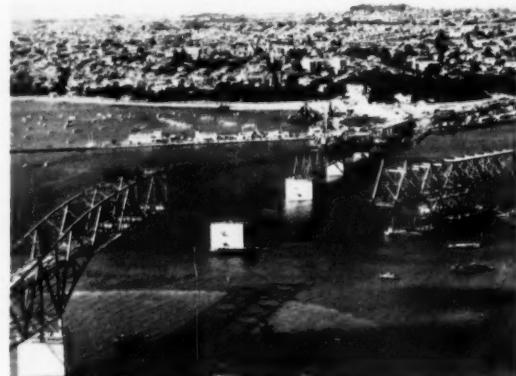
A conservative approach to structural design among Indian engineers is a major reason why some of the new steel-saving designs such as prestressed concrete and thin shell design have not been widely adopted. However, the public works departments in the states of Bombay and Assam

have introduced many of the newer methods in their projects with very satisfactory results.

A team of German engineers and architects is erecting a prototype industrial colony at Okhla near New Delhi, using precast concrete members instead of the standard Indian brick-by-brick practice. Part of the precast fabrication will be done by the state-owned Hindustan Housing Factory.

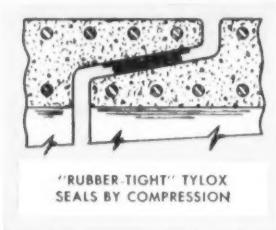
Auckland Bridge

New Zealand's Auckland Bridge, the largest bridge to be erected in the southern hemisphere for two decades, is nearing completion. The \$10 million cantilever structure will link the city of Auckland



Freeman, Fox & Partners, British consultants, designed 3500-ft bridge with an 800-ft navigation span.

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Heavy-duty, acid-resistant, flexible TYLOX Gaskets are made for large bore tongue and groove pipe. They are quickly "snapped on" to the pipe, and the pipe quickly coupled into the line. TYLOX reduces construction costs by speeding pipe coupling, and forms a compression seal that stays tight for the life of the pipe. TYLOX reduces treatment plant costs by preventing infiltration. REXON No. 2 PIPE COATING is a synthetic hard rubber which vulcanizes to pipe by catalytic action, not by evaporation which causes pin-holes. REXON No. 2 protects concrete pipe from deterioration by hydrogen sulphide gas, oils, greases and solvents. WRITE FOR MORE DETAILS.

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with the borough of Northcote. Two British contractors, Dorman Long and Co. and The Cleveland Bridge and Engineering Co., have been working on the span since 1955.

Soviet Institute of Information

R. K. Honoman, director of publications of Bell Telephone Laboratories, Inc., reports that Russia's centralized Institute of Information — which collects, translates, and disseminates technical information — far surpasses any service the United States offers. He points out that about 1000 pieces of technical literature are studied and translated each month comprising about half the world's unclassified technical data.

Although President Eisenhower has directed the National Science Foundation to form a similar central agency, engineers and scientists in this country still have no single organization they can go to for translations of current foreign technical information. With the great number of uncoordinated groups working on the problem, there is



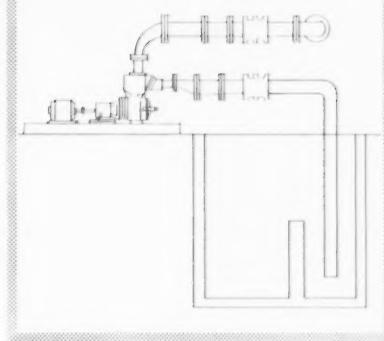
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much costly duplication of effort in this country; and much valuable data is never translated.

Honoman described how 14,000 engineers, scientists, and educators volunteer their spare time to the activities of the Institute. Incentive is gained by the prestige associated through staff membership as well as by rewards such as free cars.

Bedfordshire-Warwickshire Turnpike

The first section of a limited access, four-lane divided highway to link London with industrial Yorkshire will carry traffic 53 miles from near Luton, Bedfordshire to Rugby, Warwickshire. The \$45-million initial route includes 129 bridges. Completion is scheduled for later this year.

The biggest fleet of earthmoving equipment ever assembled in England shifted an average of 450,000 cubic yards a week when the cut and fill operations were at their peak.

Consulting engineer for the project is Sir Owen Williams & Partners.

Gravity Pipeline in Iran

One of the biggest oil fields in Iran, the Gach Saran, is to be opened up to nearly full capacity with the construction of the world's largest undersea pipeline—a 30-in. line, 25-miles long. Oil previously has been moved 200 miles overland by



This aerial view of the Bedfordshire-Warwickshire highway shows a typical underpass being erected.

pipeline to Abadan, but this city only is able to berth medium size tankers, severely limiting production from the oil field.

The new pipeline, to be finished this year, will carry Gach Saran oil over 72 miles of mountainous desert to the Persian Gulf at Ganaveh and then by undersea pipeline to Kharg Island where a new deepwater oil loading pier for the biggest tankers is under construction.

When the new pipeline is completed, at a cost of about \$56 million, oil output from the Gach Saran field will be stepped up from 60,000 to 390,000 barrels a day. Even this is not the maximum output for, at the start, oil will flow through the pipeline by gravity only, since the oil field is 2250 feet above sea level. If pumping stations are added, daily output could rise to 450,000 barrels.

Huge Radar Installation

Burns and Roe, Inc., New York consulting engineering firm, has designed a massive five-story concrete tower that supports an 80-ton radar antenna on its roof and houses its electronic and utility equipment. The tower will be erected for the Surface Armament Division of the Sperry Gyroscope Company at Thomasville, Alabama. It is the first of a number of similar installations to go up throughout the United States.

Because of the very high directional accuracy required for the heavy radar antenna, precautions were taken to limit deflection of the tower. The specifications called out a maximum deflection of 1 minute of arc at the top of the structure. The

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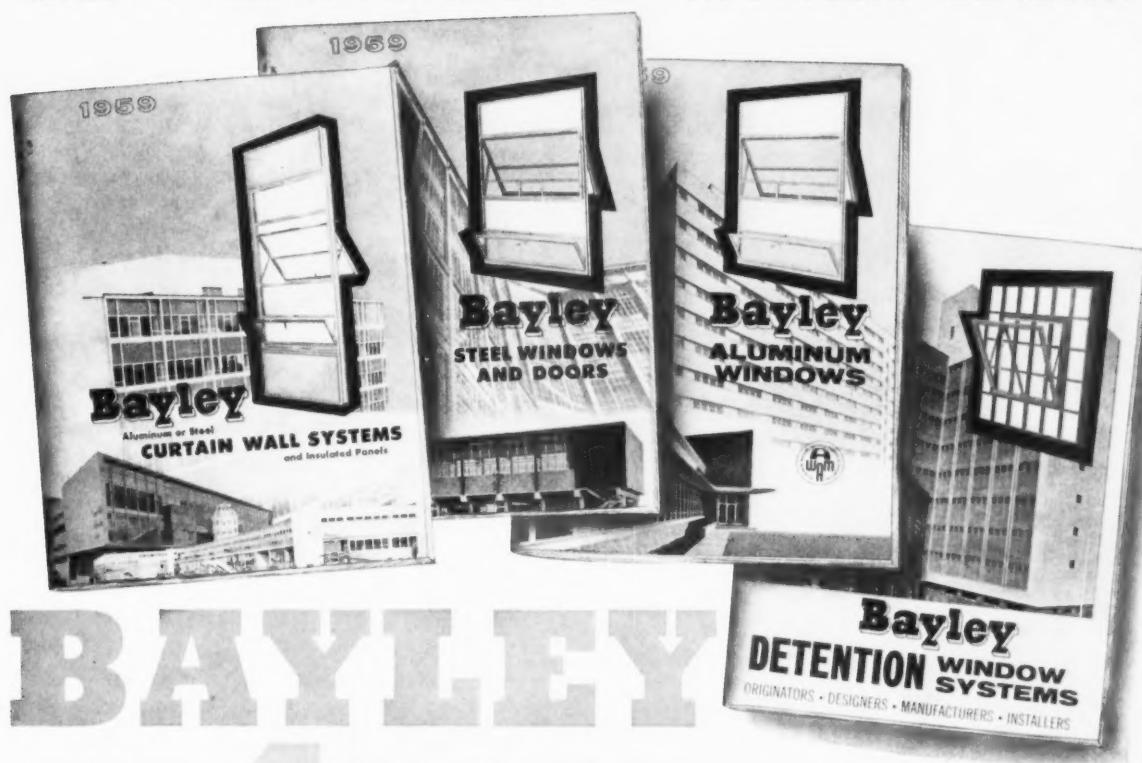
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rugged design of the foundation and batter piles coupled with the use of concrete over steel for added rigidity will keep the building within these limits. But experience gained during the design of this poured-in-place structure indicates that future designs of similar radar towers may be in steel.

Electrical distribution systems, refrigeration and air conditioning plant, and the boiler room are on the first floor. Two 50-ton air conditioning units, with an additional one of equal rating for standby duty, will dissipate the high heat load of the electronics gear. Only a very small boiler was specified for wintertime heating of the building.

The second floor houses the console room, machine shop, and maintenance and testing areas. Electronics equipment fills the third and fourth levels, the fifth floor serving to house the transmission line and its accessories. The antenna drive mechanism, mounted on the roof, includes six, 100-hp motors and the necessary reduction gears.

Titan Base Facilities

Responsibility for the design of initial Titan ICBM facilities has been awarded to Daniel, Mann, Johnson, & Mendenhall and Associates, a joint venture consisting of Daniel, Mann, Johnson, & Mendenhall, architects and engineers, Los Angeles; The Rust Engineering Company, engineers and constructors,

Pittsburgh; the Leo A. Daly Company, architects and engineers, Omaha; and Mason & Hanger — Silas Mason Company, Inc., engineers and contractors, New York City.

Already under construction at Vandenberg AFB in Lompoc, California is the Operation System Test Facility, which will permit full scale testing of the complete Titan weapon system. Also planned at Vandenberg is a training base for Air Force crews who ultimately will man the Titan; it will consist of several launching elements and will have its own control center. The first operational Titan base will go up at Lowry AFB, Colorado.

Orville Wright Junior High School

Architecturally unusual Orville Wright Junior High School in Tulsa, Oklahoma required an equally novel heating and ventilation system. Built to house 1140 students, the three-story school is circular — 191 feet in diameter. In the center is an 87-ft diameter auditorium surrounded by a 12-ft wide annulus for stairs, faculty lounges, elevators, toilets, and mechanical equipment and utilities. Surrounding this is a 10-ft corridor. Classrooms 30-ft wide ring this interior corridor.

John A. Penafeather, Tulsa consulting engineer on the \$1.5 million project, could not provide cross-ventilation in classrooms because of the shape of the building. He specified a forced air supply for each room through grilles in the inner walls, directed toward the windows. Return air flows through special combination baseboards and return air grilles extending the full circumference of the outside wall. Holes through the floors connect the return air chambers to a plenum over the ceiling of the room below. Return air either can be recirculated or roof exhausted; the system can handle 100 percent outside air.

Reheat coils are provided in each classroom to control the sensible temperature since zoning with ductwork was determined to be not feasible, again because of the building shape.

All supply air and return air ducts are sized for future addition of air conditioning. Provisions in the central heating system will permit simple and economical changeover to cooling. Estimates are that the huge school can be air conditioned for \$100,000 without alteration of any finished areas.

Architect Leon B. Senter points out that the circular design, compared to a conventional single-story building, provides 14 percent less exterior wall area, 9 percent less floor area, 38 percent less roof area, 9 percent less corridor area, and 44 percent shorter plumbing and electrical runs. Classrooms are only slightly altered from the rectangular and, although wall area is less, each room has more exterior wall area for better natural lighting. □

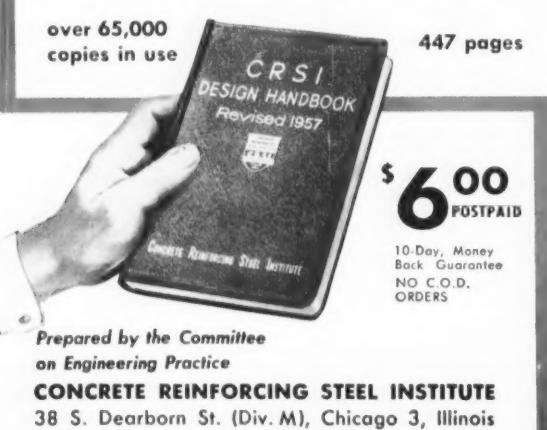
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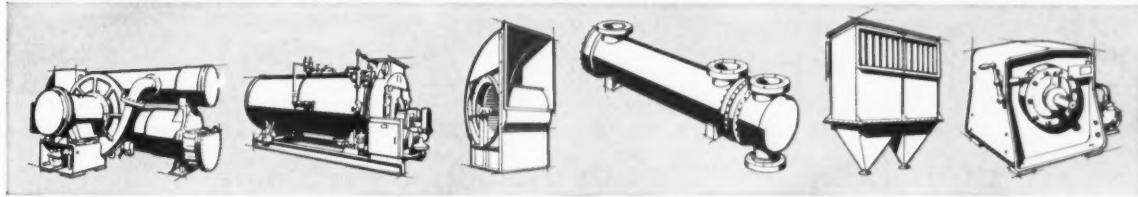
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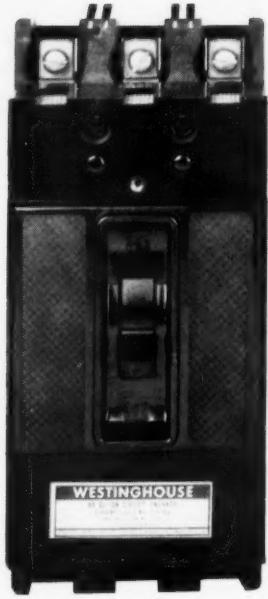
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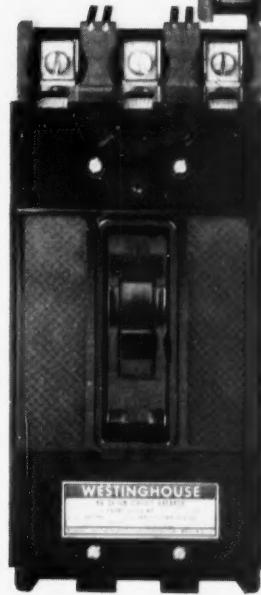
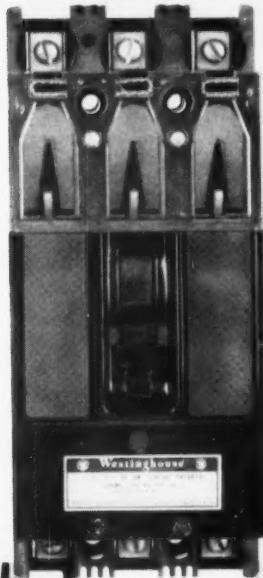
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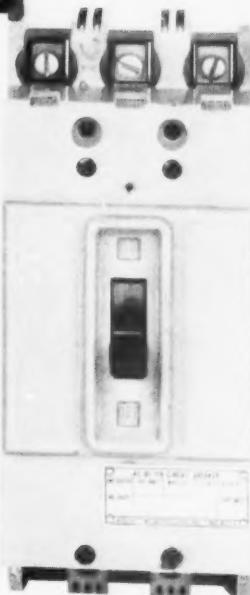
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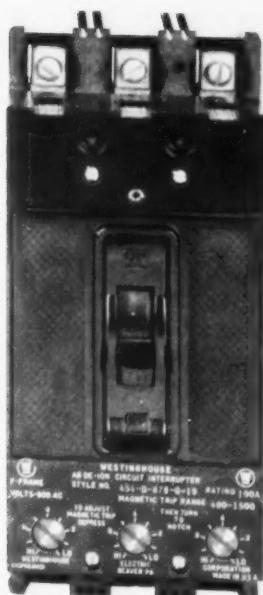
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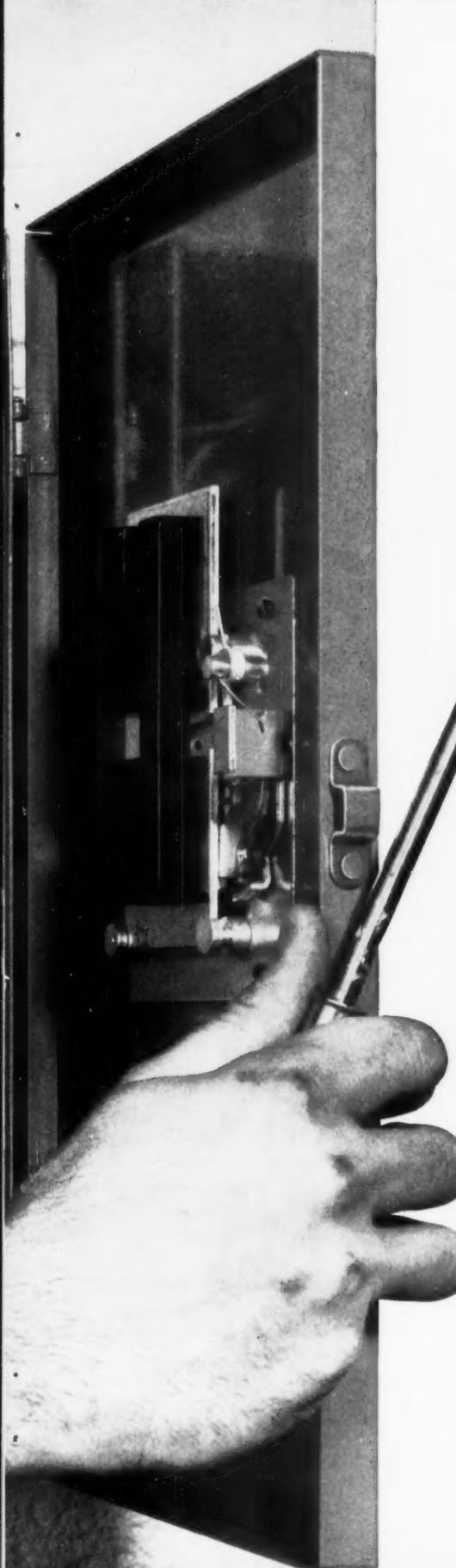
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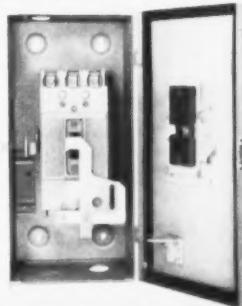
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Books

Parallel Reading for Consulting Engineers

IF THERE BE any subject in which consulting engineers are in need of instruction, it is the art of Lifemanship, or its natural extension, One-Upmanship. The average engineer, altogether unfamiliar with the ploy and counterploy, is too often beat down by architects or clients, most of whom are much more adept at these important skills. The architect has his art, the client has his money, but the knowledgeable engineer need not feel inferior in the presence of either if he studies and

practices the teachings of Stephen Potter. After all, the engineer has "know-how," and with "know-how" he should be able to top the architect and even the client at every encounter, especially if he has had some instruction in Potter's Practical Approach to the Ploy.

Stephen Potter, author of the famous volumes on *Gamessmanship*, *Lifemanship*, and *One-Upmanship* now has produced a sort of post-graduate course in *Supermanship*, or *How to Continue to*

Stay Top Without Actually Falling Apart. The title seems longer than the book, which has only 128 pages and sells for a modest \$3.00 (Random House), but even at that the book is too long for all but the most avid Potter students. It starts slowly and ends with a self-conscious, Tidworth-East Civic Association analysis of foreign relations. But in between there is some solid instruction of practical value to consulting engineers. In just 16 short pages Potter makes up for the rest. His chapter "To What Extent is There a Virtual Superlecture" should be studied by every consulting engineer who ever presents papers or acts as chairman of a meeting.

"Chairmaning," says Potter, is "the art of being one up on the lecturer . . . For example, 'the Chairman can break flow of Lecturer with such basic and even dramatic ploys as having little notes passed up to him and then making tiny 'unobserved' signals to people in the audience.' Some chairmen are able to suggest that the note contains rather bad news of a derogatory personal nature. The chairman skilled at taking the attention away from the lecturer can 'cross his right leg over his left and reveal the fact that right sock is so shrunk that it scarcely comes above the shoe at all. Audience will watch this large white naked ankle."

Then there is the chairman with the off-beat laugh. This is a slow chuckle developed during some serious part of the lecture as if the chairman were trying to lead the audience into the realization that there really was, after all, some grain of amusement in what the lecturer was saying.

At the end of the lecture the chairman can get up after a short pause, with a start, so as to suggest "Why has he suddenly left off talking?" He may then say, "Well, I am sure there will be lots and lots of you'll be wanting to ask questions . . ." It is perfectly

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By WILFRED KAPLAN, University of Michigan

Intended as a text for a first course in differential equations, the distinguishing feature of this book is its employment of the *ideas of instrumentation engineering* both as an illustration of the theory and as a way of better understanding the mathematics.

534 pp., 150 illus., 1958 — \$9.50

INTRODUCTION TO ADVANCED DYNAMICS

By S. W. McCUSKEY, Case Institute of Technology

Written at the advanced undergraduate level, the purpose of this book is to familiarize students of science and mathematics with some of the ideas of classical dynamics not ordinarily treated in courses in elementary mechanics. The emphasis is on a thorough understanding of basic principles.

263 pp., 120 illus., 1959 — \$8.50

THE GENEVA PRESENTATION VOLUMES — ATOMS FOR PEACE 1958

This indispensable reference set contains six volumes on *reactors*, four on *nuclear metallurgy and chemistry*, one on *thermonuclear research*, and one on *radiation biology and medicine*. Available as a 12-volume set or as individual volumes. Moderately priced. Detailed brochure available upon request.

ELEMENTS OF PHYSICAL METALLURGY

By A. G. GUY, Purdue University

A thoroughly revised and expanded new edition of a widely used textbook for introductory courses in physical metallurgy, which may be used either by science and engineering students or by students of metallurgy, since it treats basic principles. No previous knowledge of metallurgy is assumed.

528 pp., 297 illus., Second Edition 1959 — \$9.50

ELEMENTS OF MATERIALS SCIENCE — An Introductory Text for Engineering Students

By LAWRENCE H. VAN VLACK, University of Michigan

An introduction to engineering materials, on an elementary level, for all students of engineering. Gives the prospective engineer, regardless of his future field of specialization, a basic understanding of the structure of materials and the conditions under which they will be used.

c. 480 pp., 559 illus., 1959 — \$8.50

QUANTITATIVE MOLECULAR SPECTROSCOPY AND GAS EMISSIVITIES

By S. S. PENNER, California Institute of Technology

A convenient and accessible source of reference material on basic radiation problems which fall, to a large extent, into the temperature range intermediate between that of interest to the molecular spectroscopist and to the astrophysicist. The classical results of radiation theory are used for the solution of the problems.

c. 570 pp., 212 illus., to be published September 1959 — \$15.00

INTRODUCTION TO PLASTICITY

By WILLIAM PRAGER, Brown University

Based on a series of lectures that the author gave at the Federal Polytechnic Institute in Zurich, and which were originally published in the German language in 1955. By restricting the scope of the book to selected topics from the theory of perfectly plastic solids, the author is able to bring the reader up to the frontiers of current research without presupposing prior familiarity with the subject.

c. 128 pp., 82 illus., to be published September 1959 — \$6.50

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easy by the intonation to discourage the asking of any questions whatsoever.

Potter has equally good suggestions for the lecturer, himself, including Lens Drill. When the lecturer finally gets a laugh, he takes off his glasses slowly and sadly and rubs fingers into tired marks under eyes. "The real expert, making a particularly boring or pointless remark, can sometimes succeed in hypnotizing the audience into thinking he has said something effective by speeding up, rapidly diminishing the volume of his voice and dashing spectacles on the desk, looking at his audience with corkscrew intentness."

With just a few hours study of this chapter, a consulting engineer, beefed-up with a background of "know-how," should be able to present successfully before an annual meeting of the American Institute of Architects a paper on "My Mood Memories of 17th Century Stained Glass."

NOT IN YEARS has there been a book published so important to engineers as L.W.H. Hull's *History and Philosophy of Science*. Yet, it has little to say about engineering. The author even denies that engineering is a science. "The so-called applied sciences, such as engineering, navigation, and medicine, are *useful arts*." This should not disturb the engineer. If he is an artist (or artisan) in respect to his work, his education must be scientific. "Mechanics, the study of rest and motion, is a science; engineering is an art based mainly upon it."

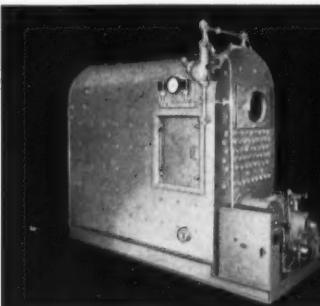
When we speak, these days, of the need for a study of fundamentals in our engineering schools, we are asking for more concentration on mathematics, physics, and chemistry, and these are the subjects Hull dwells on in this book. If he concentrates too much on mathematics and physics, so much the better for engineers.

A history of engineering, in its narrow sense, can be little more

than a great list of frequently brilliant but relatively minor accomplishments, which taken together have greatly changed the day to day life of civilized man. The history of science is something else. Every great scientific discovery has picked the engineer up by the seat of his pants and turned him down a totally new path. It is interesting to develop this thought further by comparing the number of really basic scientific discoveries (perhaps no more than 10 or 20) with the number of engineering "discoveries" represented by the flood of new product descriptions found in each morning's mail. Changes in basic scientific concepts are revolutionary but rare (Euclidian geometry was unchanged for 2000 years). Developments in engineering are so rapid that the most recent text is out of date before it reaches the college student's desk.

In this new book, Hull has explored only the fundamental changes in scientific thought. They are so few that their selection seems simple. There is Greek geometry, with its purely deductive system; the Alexandrian school, with the first important emphasis on observation and the inductive scientific method; the Middle Ages, with a retreat from reason to authority; the Renaissance, with reason returned but a continuation of the conflict between induction and deduction; and finally the age of modern science, in which induction based on observation became the accepted scientific approach.

In reading this book, most engineers will be astounded at the simplicity of the fundamental concepts of science. The tremendous discoveries of Archimedes, Copernicus, Galileo, and Newton seem highly complex when presented in an engineering text alongside the practical formulas required for the solution of the engineering problems to which they apply. In this book, set forth as pure reason, they seem so simple and clear that



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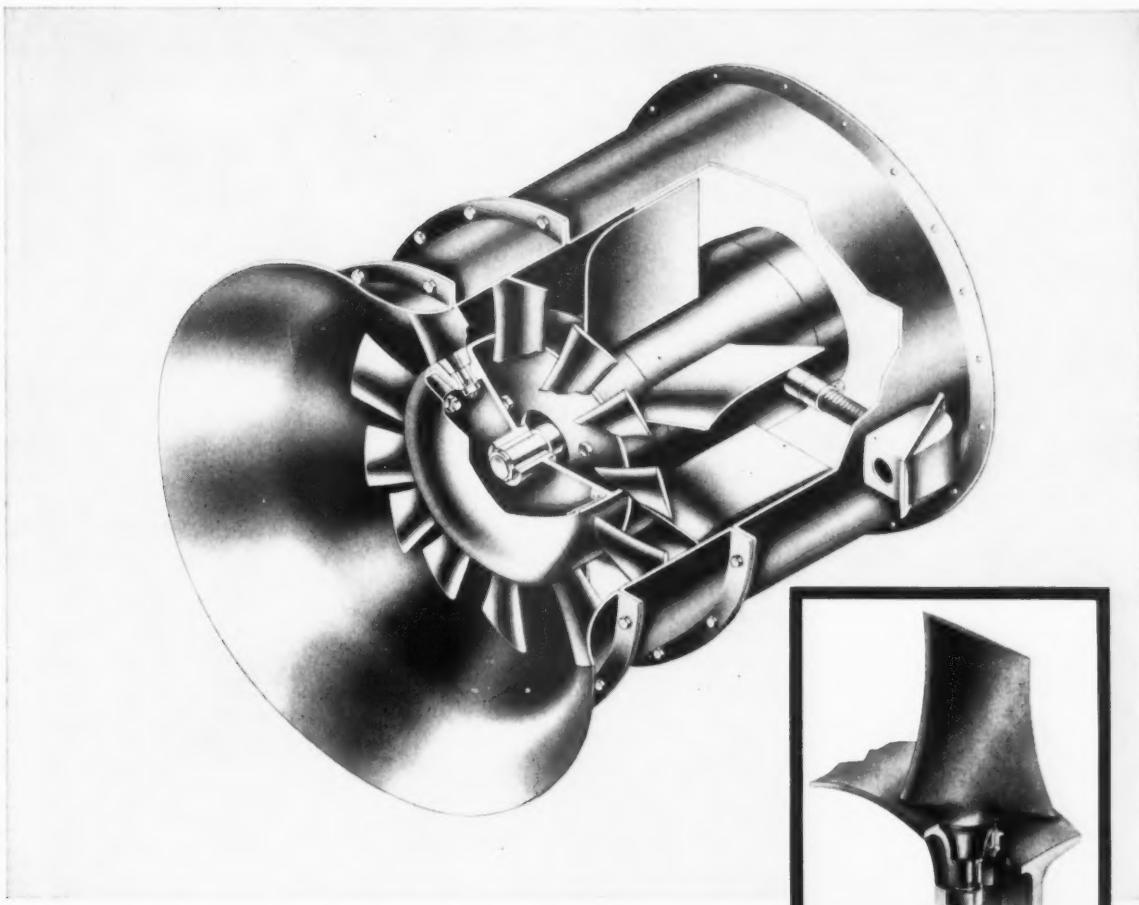
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most engineers will feel that they had no need of the formulas and the details of handbooks; they could have derived that data themselves. While that is certainly an exaggeration, and much credit must be given to the engineers who managed to apply the fundamentals of science to stone and steel, it remains true that a good history of pure science, which this book is, suddenly shows the engineer that he is not dealing with thousands of facts, which no man could keep in his head, but with only a few basic concepts, which change not day by day but century by century at most.

The engineer is in a most fortunate position as a reader of this history. An engineering education permits him to understand without great mental struggle every argument or explanation of the author. He can follow each page with ease (which most laymen could not), yet it presents material few engineers have had a chance

to correlate, or, in many instances, even to consider.

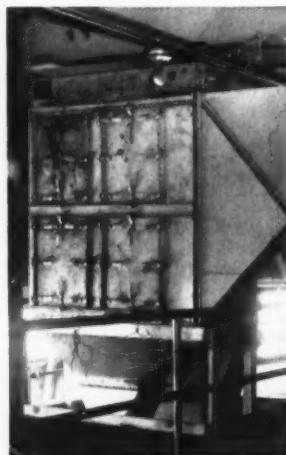
While the author has called his book a *History and Philosophy of Science*, he might, with equal logic, have transposed the conjunction and the preposition in the title, for the book certainly includes some history of philosophy as well as philosophy of science. Plato is as important here as Newton, though the author examines Plato primarily as a scientific thinker, and in this field finds him lacking. The theme of the book involves a comparison of the Platonic method (Plato advised the student of astronomy to turn his eyes away from the heavens and look inside his own mind for his answers) and the inductive scientific method that bases its conclusions on the reasoned correlation of observed phenomena. The author, reminding the reader that he is dealing here with science, not with ethics or morals, shows how reason combined with observation is superior

to reason alone. He points out that pure reason without observation has been successful only in geometry, and that the Greek assumption that this same method could be applied to other pure sciences, was an error that confused and retarded scientific thought even more than the authority of the Church of the middle ages. It was, in fact, Plato and Aristotle rather than Scripture to which the Church turned to establish authority for scientific dogma, and unfortunately it managed to overlook Aristotle's excellent work in biology and zoology, where he combined observation with inductive reasoning, and pointed instead to his conclusions in other branches of sciences in which he was little interested and generally incompetent — areas in which he stuck close to Plato.

It is hard to overestimate the value of this book for the engineer. It fills in and brings together exactly those fundamentals of science the average engineer too often has neglected as a result of his specialization. It is not only an excellent book for the consulting engineer, its adaption as a text in engineering schools also would be of practical benefit.

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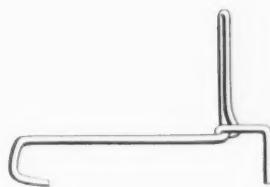
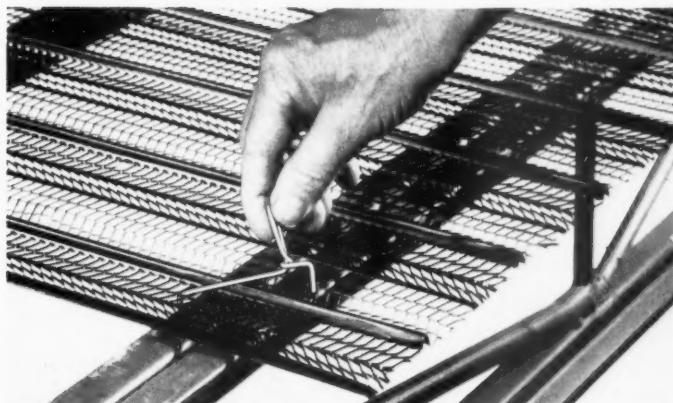
Supermanship, by Stephen Potter, \$3.00, Random House, Inc., 457 Madison Ave., New York 22, N.Y.

History and Philosophy of Science, by L.W.H. Hull, \$5.00, Longmans, Green and Co., 55 Fifth Ave., New York 3, N.Y.

To get your copy of these books, order through your local book store, or use the order form on page 214.

New Technical Books

ADVANCED MECHANICS OF FLUIDS, edited by Hunter Rouse; John Wiley & Sons, Inc., N.Y.; \$9.75. This is a sequel to Rouse's *Elementary Mechanics of Fluids* and



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deals with the development of research methods giving primary emphasis to the theoretical approach. The material in this book is by no means elementary, and it is designed either for graduate studies or engineers working in this field.

THE THEORY AND DESIGN OF MAGNETIC AMPLIFIERS, by E. H. Frost-Smith; John Wiley & Sons, Inc., N.Y. \$12.50. The aim of this book is to give an account of theory of magnetic amplifiers and to link up the theory with the design in a way that will be of value to the professional engineer. Many of the theoretical aspects are supplemented by short numerical examples, and a number of complete designs are included.

THE CHEMISTRY OF INDUSTRIAL TOXICOLOGY, 2nd ed., by Hervey B. Elkins; John Wiley & Sons, Inc., N.Y.; \$11.50. Since the publication of the first edition of this book in 1950, the number of potentially

menacing substances being used in industry has greatly increased. This second edition includes information on all the new or newly recognized hazards including insecticides and radioisotopes.

FILLER METALS FOR JOINING, By Orville T. Barnett; Reinhold Publishing Corp., N.Y.; \$7.00. This reference book presents reasons for and summarizes industrial practice in specifying the proper filler metal for any metal joining situation. It covers all the ferrous and nonferrous joining metals and includes chapters on new iron powder electrodes, latest developments in nonferrous metals, and surfacing and tungsten electrodes.

STATISTICAL QUALITY CONTROL, by D. H. W. Allan, Reinhold Publishing Corp., N.Y.; \$3.50. A small but interesting volume giving a good picture of statistical quality control without going into detailed mathematical concepts. It deals

primarily with the aims and application of statistical quality control, and therefore, is a good selection for the consulting engineer's library.

SEMICONDUCTORS, edited by N. B. Hannay; Reinhold Publishing Corp., N.Y.; \$15.00. This book is an excellent reference on the physical chemistry and fundamental physics of semiconductors, with detailed analyses of important semiconducting materials. The emphasis throughout is on basic principles and phenomena. The chemical aspects and the physics of semiconductor behavior are exhaustively treated. A valuable book on this special topic.

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Supermanship, by Stephen Potter, Random House, Inc., N.Y.; \$3.00.

The History and Philosophy of Science, by L. W. H. Hull; Longmans, Green and Co., Inc., N.Y.; \$5.00.

Advanced Mechanics of Fluids, edited by Hunter Rouse; John Wiley & Sons, Inc., N.Y.; \$9.75.

The Theory and Design of Magnetic Amplifiers, by E. H. Frost-Smith; John Wiley & Sons, Inc., N.Y.; \$12.50.

The Chemistry of Industrial Toxicology, 2nd ed., by Hervey B. Elkins; John Wiley & Sons, Inc., N.Y.; \$11.50.

Filler Metals for Joining, by Orville T. Barnett; Reinhold Publishing Corp., N.Y.; \$7.00.

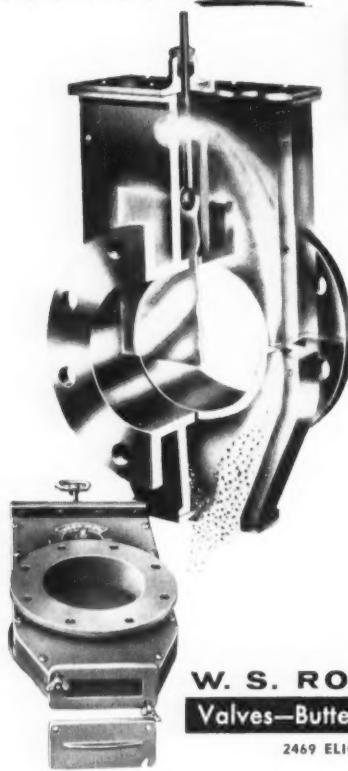
Statistical Quality Control, by D. H. W. Allan; Reinhold Publishing Corp., N.Y.; \$3.50.

Semiconductors, edited by N. B. Hannay; Reinhold Publishing Co., N.Y.; \$15.00.

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SLIDE VALVES from the lines for cleaning

For fluids, air or gases containing solids or for free flowing granular materials that clog or jam conventional valves—Kwikleen is the answer.

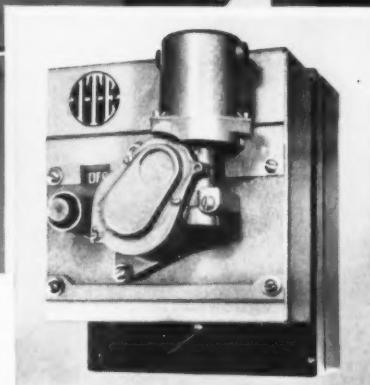
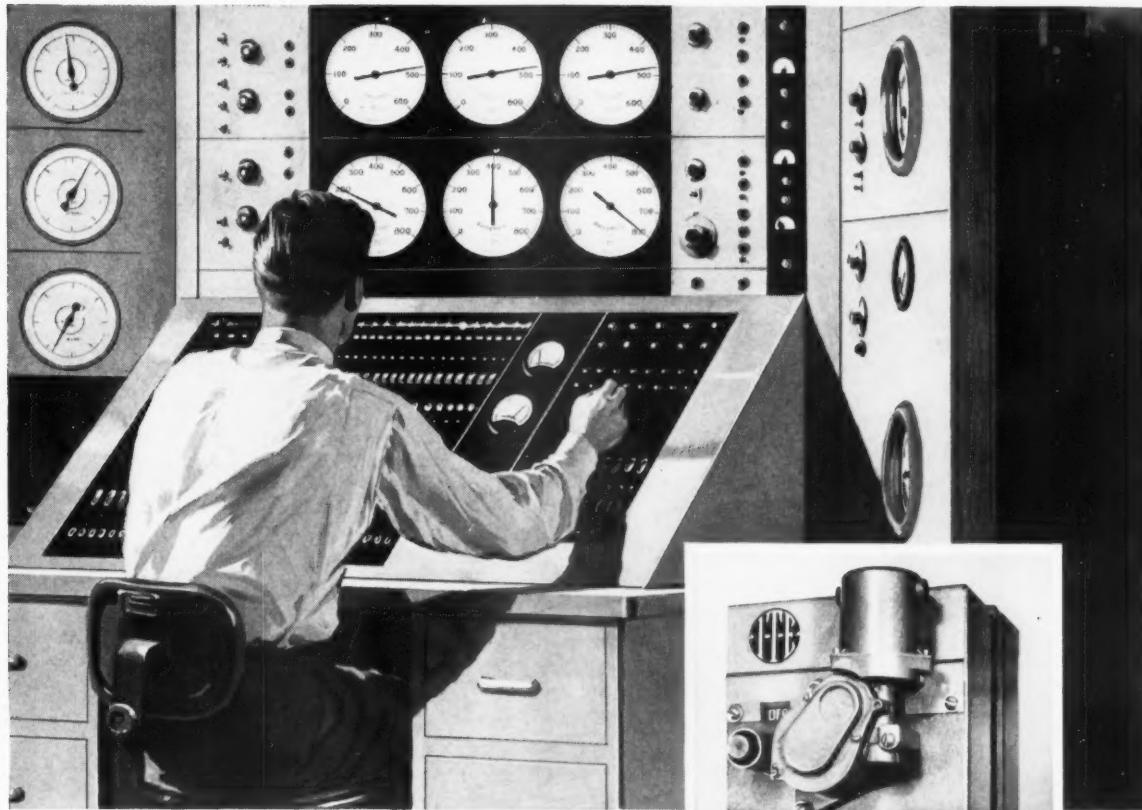
It permits 100 per cent flow in full open position and quick shut-off manually or mechanically. Easily, quickly cleaned by removing bottom plates. The valve need not be removed from the line. Sediment drops out or can be blown or flushed out by air or water.

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2469 ELIOT STREET • FAIRFIELD, CONN.



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NEW EXCLUSIVE DESIGN I-T-E TELEMAND*

Remote Control of Molded Case Circuit Breakers

I-T-E Circuit Breaker Company now offers the electrical industry another exclusive—the new TELEMAND. This I-T-E designed device is the sturdiest, most foolproof, compact and economical unit ever built for electrically opening, closing or resetting molded case circuit breakers by remote control.

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I-T-E'S TELEMAND is industry's first really satisfactory answer to remote control of molded case circuit breakers. In remote control applications, the I-T-E TELEMAND ET Breaker combination may be used where bulkier, more expensive equipment would be required.

It is particularly appropriate for use in automatic transfer schemes and is ideal for use as a combination switch and protective device. Write today for full details. I-T-E Circuit Breaker Co., 1900 Hamilton St., Phila. 30, Pa.

*Trademark, I-T-E Circuit Breaker Co.

[†]Amp-trap is a registered trademark of the Chase-Shawmut Company



I-T-E CIRCUIT BREAKER COMPANY



Modern air-conditioned home of Kal, Ehrlich & Merrick, Washington, D.C. advertising agency

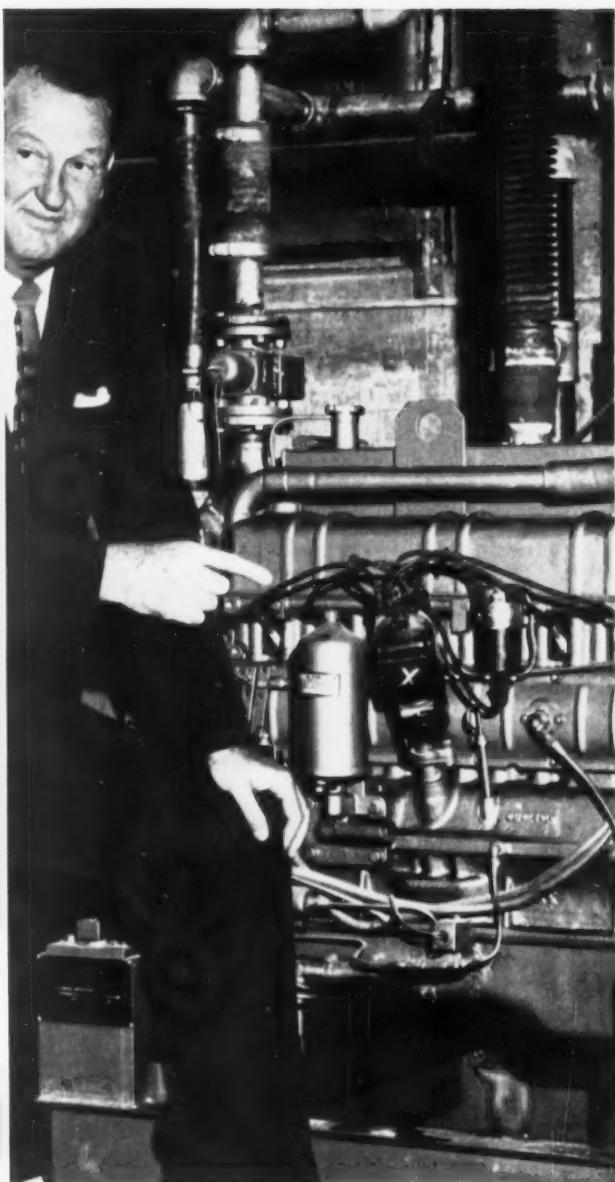


"Nothing to do—but enjoy it, with our all-

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"Only the best air conditioning system would do for our new building, and experience proves the best is definitely gas", continues Mr. Merrick. "Our Ready-Power air conditioner gives us the exact climate control we want every day of the year . . . and it's extremely inexpensive to operate."

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Gas-operated unit provides exact climate control, adds to the efficiency of agency's creative people.

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Lowest Silhouette Design FORWARD OR BACKWARD CURVE WHEEL WITHIN . . . OR OUT OF SCROLL HOUSING

Motor mounting on side of structure support . . . out of line of air stream reduces height of Lo-Boy models nearly 50% of older designs.

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Men in Engineering

Frank R. Sherman has been appointed operations manager of the International Division of Daniel, Mann, Johnson, & Mendenhall, Inc., architectural and engineering firm of Los Angeles. Before joining DMJM, Sherman's most recent assignments were as construction engineer of the Metropolitan Fair and Exposition Authority in Chicago and as executive engineer for Urbahn, Brayton & Burrows.



SHERMAN

WITT

Dr. J. C. Witt, Chicago consulting engineer specializing in cement and concrete, has become affiliated with Maurice H. Connell and Associates, architectural-engineering firm of Miami, Florida. Witt will serve as an associate consulting engineer with the Connell firm and also will continue to operate his Chicago office.

Philip Abrams, formerly project engineer for James M. Montgomery, consulting engineer, has been named an associate of Engineering-Science, Inc. Manager of the firm's southern California operations, Abrams will be in charge of

water and sewerage projects, including the design of water and sewage treatment facilities, as well as water distribution and sewage collection systems. He also will handle the preparation of feasibility reports and rate studies.

Matthew G. Eggett, chemical engineer, has joined Holladay & Westcott, consulting engineers of Los Angeles. His principal activities in the firm will be in the field of waste disposal and water treatment. Eggett formerly was assistant executive officer of the State of California Regional Water Pollution Control Board No. 4.

H. Hudson Myers, Jr. has been appointed an Associate Engineer of the firm of Whitman, Requardt and Associates, Engineers of Baltimore, Maryland. Myers, with the firm since 1951, supervises the design of highways, bridges, airfields, storm drains, and utilities.

Several engineers have been appointed to management positions by the John Graham Company, Architects-Engineers, with main offices in New York City and Seattle, Wash. Two professional engineers — Roderick Kirkwood, Seattle and Henry Birner, New York — have been named partners.

The engineers named associates are: James D. McWalters, structural engineering director and Milton H. Edelman, electrical engineering director, New York; Anthony P. Burzenski, civil engineer-

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LONGER VALVE LIFE AT NEW LOW COST!

Teflon-faced diaphragms**





Penton*-lined bodies

Hills-McCanna Diaphragm Valves—lined with Penton plastic and equipped with one-piece Teflon-faced diaphragms—are ushering in a whole new era of extra valve life and lower valve costs.

PENTON-LINED VALVES are suitable for operating temperatures up to 300° F. Penton-lined valves will save you money because they meet many service requirements that formerly called for costly stainless steel or glass-lined bodies—yet are competitively priced with rubber-lined valves. In addition to having superior corrosion resistance, they are non-contaminating—cannot affect

a product's taste, aroma, or color—work equally well with metallic, plastic, glass or lined piping.

TEFLON-FACED DIAPHRAGMS are suitable for temperatures up to 240° F. They can handle concentrated sulphuric or hydrochloric acids, chlorinated hydro-carbons, and esters. The Teflon facing is permanently bonded to an elastomeric backing—provides long life, assures positive closure. Teflon-faced diaphragms save you money because they often meet the same service requirements as solid Teflon diaphragms at much lower cost.

*Penton is a registered trademark of Hercules Powder Company.

**Patent applied for. †Teflon is a registered trademark of E. I. DuPont.



FIND OUT HOW TO MAKE BIG COST-SAVINGS with packless, drip-tight Hills-McCanna Diaphragm Valves. See how these simplest-of-all valves can help you make important savings. Ask for new Bulletin 115 today.

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No more wasted hours in the solution of cut and fill, grade profile, traverse closure, field stakeout, highway alignment. The compact, completely mobile LGP-30 saves time and money in the design of highways, bridges, dams... gives you desk-side computation at remarkably low cost.

The large capacity LGP-30 has a memory of 4096 words and is by far the easiest computer to program. Answers are printed out directly — require no deciphering. Self-cooled, the LGP-30 simply plugs into any convenient wall outlet... can be operated with only minimum computer experience. Auxiliary high-speed input-output equipment is available for system expansion.

No expensive installation or air-conditioning required. Customer training is free. An extensive library of programs and sub-routines is available—as well as membership in an active users organization. Sales and service facilities maintained coast-to-coast. For further information and specifications, write Royal McBee Corporation, Data Processing Division, Port Chester, N.Y. In Canada: The McBee Company, Ltd., 179 Bartley Drive, Toronto 16.

ROYAL MCBEE • data processing division

ing director, Howard Leuschen, structural engineering director, and Gerald R. Cysewski, traffic and highway engineering, Seattle.

Paul C. Nail has joined Bernard Johnson & Associates, consulting engineers of Houston, Texas, as project engineer. Nail formerly was vice president of Walker & Associates, Houston consulting engineering firm.



NAIL

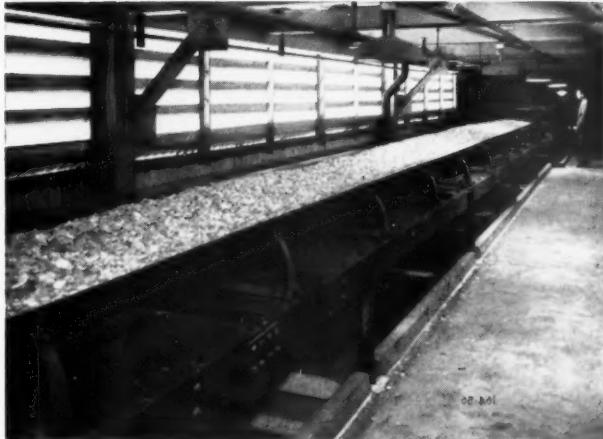
THORMYER

George J. Thormyer, recently retired chief engineer of the Ohio Highway Department, has joined Photronix, Inc. of Columbus, Ohio. Thormyer will serve as executive vice president of Photronix and also will be assistant chief engineer of its associated consulting firm, Barrett Associated Engineers.

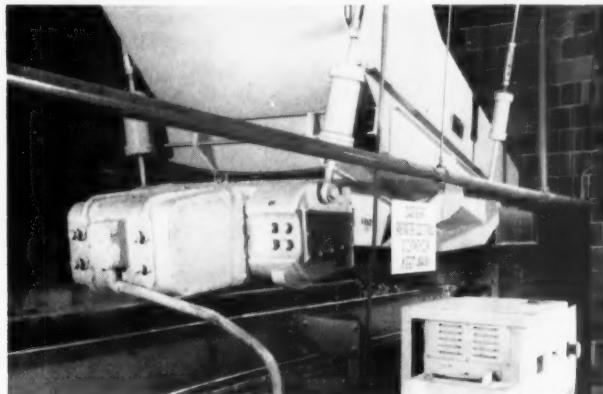
Marvin E. Mathewson, Russel W. Bandemer, John R. Morris, Malcolm G. Duncan, and Max Cardiff have been named partners of A. M. Kinney Associates, architectural and engineering firm of Cincinnati, Ohio and New York City.

Berger Associates, Inc., consulting engineering firm with offices in Orange, New Jersey; Harrisburg, Pennsylvania; and Geneva, Switzerland announce the opening of a new office at 200 S. Main Street, Salt Lake City, Utah. Hugh McKellar has been appointed managing engineer.

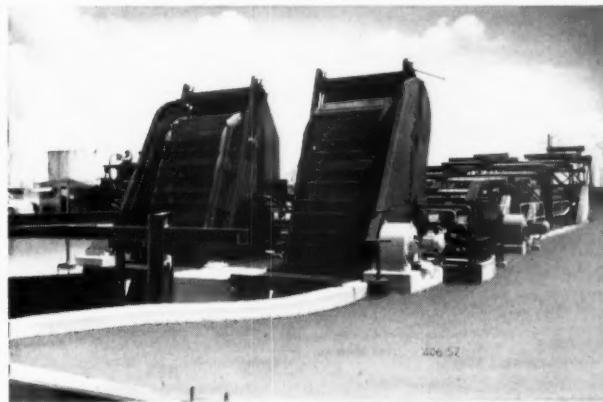
A new consulting engineering firm, Snyder, Palmer, Toussaint and Associates, Inc., with offices at 1645 Hennepin Avenue, Minneapolis,



Jeffrey belt conveyors transport wood chips to storage towers . . . move material to giant digesters as needed for production of chemical cellulose at Rayonier's Jesup plant.



Jeffrey vibrating feeders automatically control flow of materials in a wide range of processing operations. Here, wood chips are metered from a remote-control location.



Jeffrey bark and grit removal equipment for clarification of processed water.

*when they expanded
this chemical
cellulose plant,
they **re-ordered**
JEFFREY equipment*

RAYONIER'S new plant at Jesup, Georgia, is a twin to the plant built there in 1954. Each has the capacity to produce over 300 tons of chemical cellulose per day. The remarkably low-cost production facilities were designed and constructed by Ebasco Services Incorporated.

Duplication of the original mill indicates the satisfactory performance realized with the original equipment . . . including Jeffrey vibrating feeders, belt conveyors, bark and grit removal equipment.

Planning to expand your production? It will pay you to call in Jeffrey. For information on Jeffrey equipment for your requirements write The Jeffrey Manufacturing Co., 822 North Fourth Street, Columbus 16, Ohio.



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- **COMPACT, INTEGRAL PUMP AND MOTOR UNITS**
- **For Hydraulic, Pressure Feed, Transfer Work**



.3 to 55 GPM
Pressures to 400 PSI

NOW... A CHOICE OF 192 MODELS

Roper has expanded its line of Series T rotary pump units to take care of a wider range of uses pumping clean liquids. These "all-in-one" units, with pump serving as the end bell of the motor, are easily installed and have minimum space requirements . . . no coupling is required . . . each unit is approximately same size as standard NEMA motor of HP required for driving. For your specific application consult the Roper representative in your vicinity.



- **COMPLETE, COMPACT UNITS**
- **LOW FIRST COST**
- **MOUNT IN ANY POSITION**
- **LONG LIFE SERVICE**
- **LIGHT WEIGHT**



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ROPER HYDRAULICS, INC.
334 Blackhawk Park Avenue
Rockford, Illinois

Roper Series T units are available in short, low and larger units with open drip proof or totally enclosed motors, single or three phase as required. Typical applications include: hydraulic door openers, work table movement, hospital beds, dental chairs, general transfer, as well as metering jobs on a wide variety of applications.

ROPER
ROTARY PUMPS

Minnesota, has been formed. Principals of the firm are J. Robert Snyder, Eugene P. Palmer, and Francis J. Toussaint. The new company offers mechanical and electrical engineering services.

Donald M. Tucker, P. E., has become a member of Outlaw and Associates, Consulting Engineers & Land Surveyors, with offices in Melbourne, St. Augustine, and Fort Myers, Florida. Announcement also has been made that the firm name has been changed to Outlaw, Tucker and Associates, Consulting Engineers.

Wallace J. Beckman and Edward T. Davel have been named associates of Consoer, Townsend and Associates, consulting engineers of Chicago, Illinois.

J. H. Foote, chief engineer of Commonwealth Associates, Inc. and vice president and director of engineering for Commonwealth Services, Inc., Jackson, Michigan, has been nominated to be president of the American Institute of Electrical Engineers. Foote, active for many years in Institute affairs and in Michigan engineering circles, has just completed a term as vice president of AIEE and prior to that had served as a director.



Fabian Bachrach



POOR

William B. Poor has been elected senior vice president of Ford, Bacon & Davis, Inc., engineers and business consultants of New York City. As vice president and manager of the firm's construction department, Poor has had direct

BRAND NEW

OASIS WATER COOLER

FULL 3 GPH

AT LOW COST

Newest addition to the famed Oasis water cooler line is the convenient Model 3P with 3 GPH capacity.

Since $\frac{1}{4}$ of all water cooler locations require a cooler in this size range, Oasis Model 3P fills a big need. It is ideal for small offices. And it fills the need for two or more coolers for large offices and light industry, to save time going to and from the water cooler. Serves 36 people in offices and schools, 20 people in light industry.

From base to bubbler, the new Model 3P is engineered for the same high quality and top performance as every other cooler in the Oasis line . . . broadest in the industry. Oasis Model 3P is a low cost water cooler that you can specify with the utmost confidence.

For greatest satisfaction, specify Oasis water coolers. We will gladly send complete information on Model 3P or any other of the 17 Oasis water coolers.



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most complete line of water coolers.

Distributed in Canada by G. H. Wood & Co., Ltd.

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Send complete information on Oasis water coolers, including the new Model 3P water cooler.

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charge of work for the natural gas industry and general supervision of all construction. Poor also is a member of the executive committee of Ford, Bacon & Davis as well as vice president and director of two of its subsidiaries.

Announcement also was made of the appointment of Russell P. Westerhoff as chief engineer and of Stuart R. Fleming as manager of the engineering department.

Laurence Wylie, consulting electrical engineer, Seattle, Washington, has been elevated to the grade of Fellow of the American Institute of Electrical Engineers for "pioneering contributions to the design, construction, and operation of an electrified railroad and its equipment."

L. N. Ross, Nebraska's former state engineer, has become an associate and chief highway engineer of Kirkham, Michael and Associates, consulting engineering firm of

Omaha, Oklahoma City, Fargo, and Rapid City.

D. E. O'Connor and T. J. Merritt have joined the Houston, Texas engineering department of Commonwealth Services, Inc. O'Con-



O'CONNOR

MERRITT

nor will act as chief engineer of the Houston office and Merritt will be responsible for industrial engineering in Houston.

George S. Richardson, senior partner of Richardson, Gordon and Associates, consulting engineers of

Pittsburgh, has been elected president of the American Institute of Consulting Engineers. Richardson succeeds Herschel H. Allen.

Elected as members of the governing Council were: S. C. Hollister, Dean, College of Engineering, Cornell University, Ithaca, N. Y.; Harold M. Lewis, consulting engineer, New York City; and Gerald T. McCarthy, partner, Tippett-Abbott-McCarthy-Stratton, Consulting Engineers, New York City.

Announcement also was made of the election of the following vice presidents of the Institute: Emil H. Praeger, partner, Praeger-Kavanaugh, Consulting Engineers, New York City, and Dean G. Edwards, partner, Edwards and Kelcey, consulting engineers, Newark, N. J.

Goodkind & O'Dea, consulting engineers of Hamden, Conn., Chicago, Ill., Bloomfield, N. J., and New York City, announce that John W. Kinney has joined the firm as director of field operations. Kinney was resident engineer for the Mackinac Bridge project.

Nine member firms of the Association of Consulting Engineers of France have established a joint engineering organization, U.T.I.C.I., at 4 Rue de la Paix, Paris. The new venture is organized to serve clients on a world-wide basis. A brochure in English, Spanish, and French is available on request.

William H. McFarland, P.E. and John W. Johnson, P.E. announce the formation of a new partnership, McFarland-Johnson, Consulting Engineers, with principal offices at 333 Front Street, Binghamton, New York and 405 Sidway Building, Buffalo, New York.

A new partnership, Olsen and Ratti, has been formed for the practice of structural and civil engineering. Principals are Bruce C. Olsen and Dean B. Ratti. Firm address is 1411 Fourth Avenue, Seattle, Washington.

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FOR MOVING**

AIR

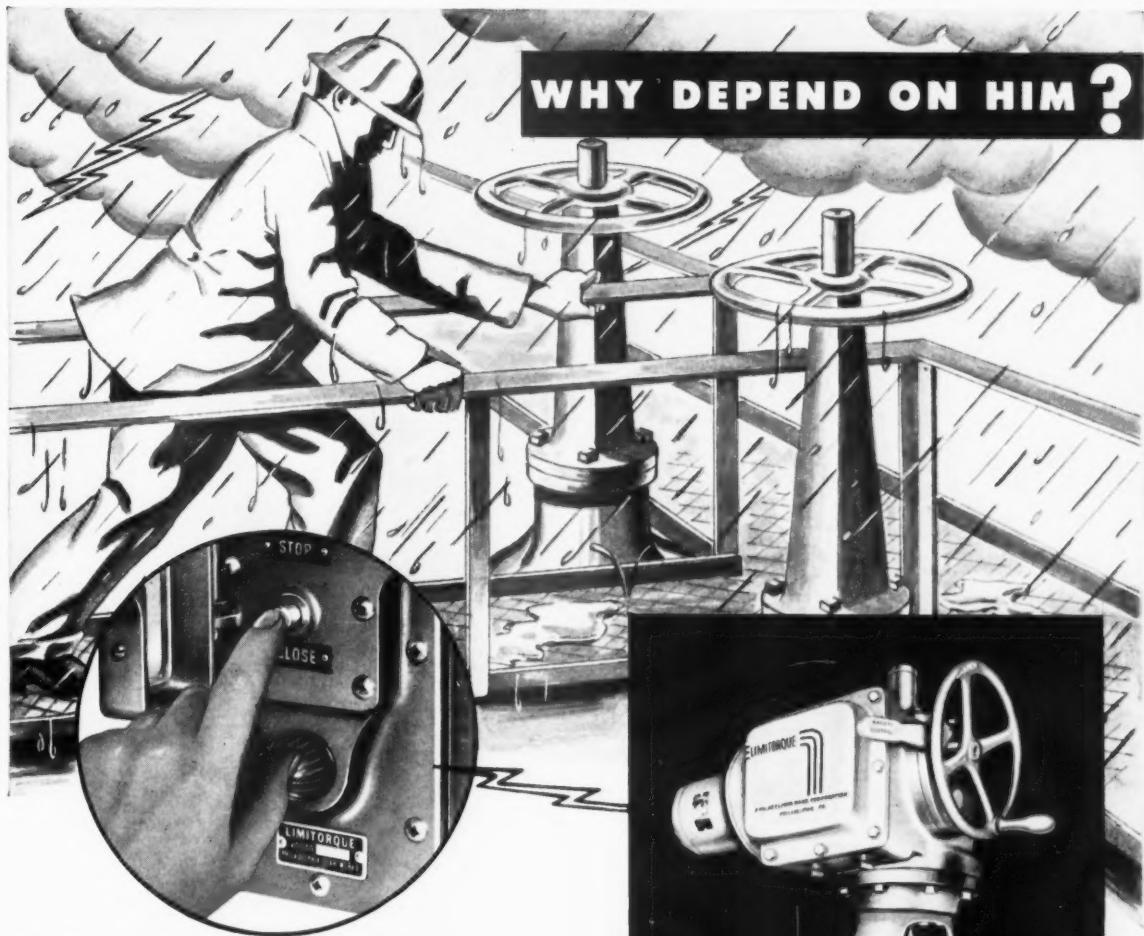
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Forward Curved Blade Blowers for Air Conditioning, Heating and Ventilating Systems. Large air volume with low R.P.M. Smaller space requirements with high mechanical efficiency. Low internal resistance — low shock loss. Engineered for exacting performance. Rugged construction for long life. Use for all industrial and commercial air supply requirements and many exhaust applications. Available in Class 1, Class 2, Class 3, and Class 4 construction.

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WILL DO IT THE EASY, SAFE WAY

Whether hand operating conditions of valves involve snow, ice, slush, high winds, torrential rains, high temperatures and dust storms, or climbing to high, inaccessible and hazardous valve locations—LIMITORQUE PROVIDES COMPLETE SAFETY TO WORKMEN, because it operates valves automatically by the "mere push of a button," from a centrally located panel-board . . . and, what is also vitally important, LIMITORQUE PROTECTS VALVE OPERATING PARTS by a torque limit switch, which instantly shuts off the motor if obstructions are met during valve operation. . . . Yes, it will pay you to equip your hand-operated valves with LimiTorque Motorized Valve Operators.

Thousands of valves of all types throughout the world are operated day-in and day-out by LimiTorque Controls, at just the correct speed desired—safely and dependably.

LimiTorque is available for actuation by any power service: Electricity, Oil, Gas, Water, or Air . . . and, if desired, can be equipped for Micro-Wave Control.

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Send for Catalog L-550 and please use your Business Letterhead.



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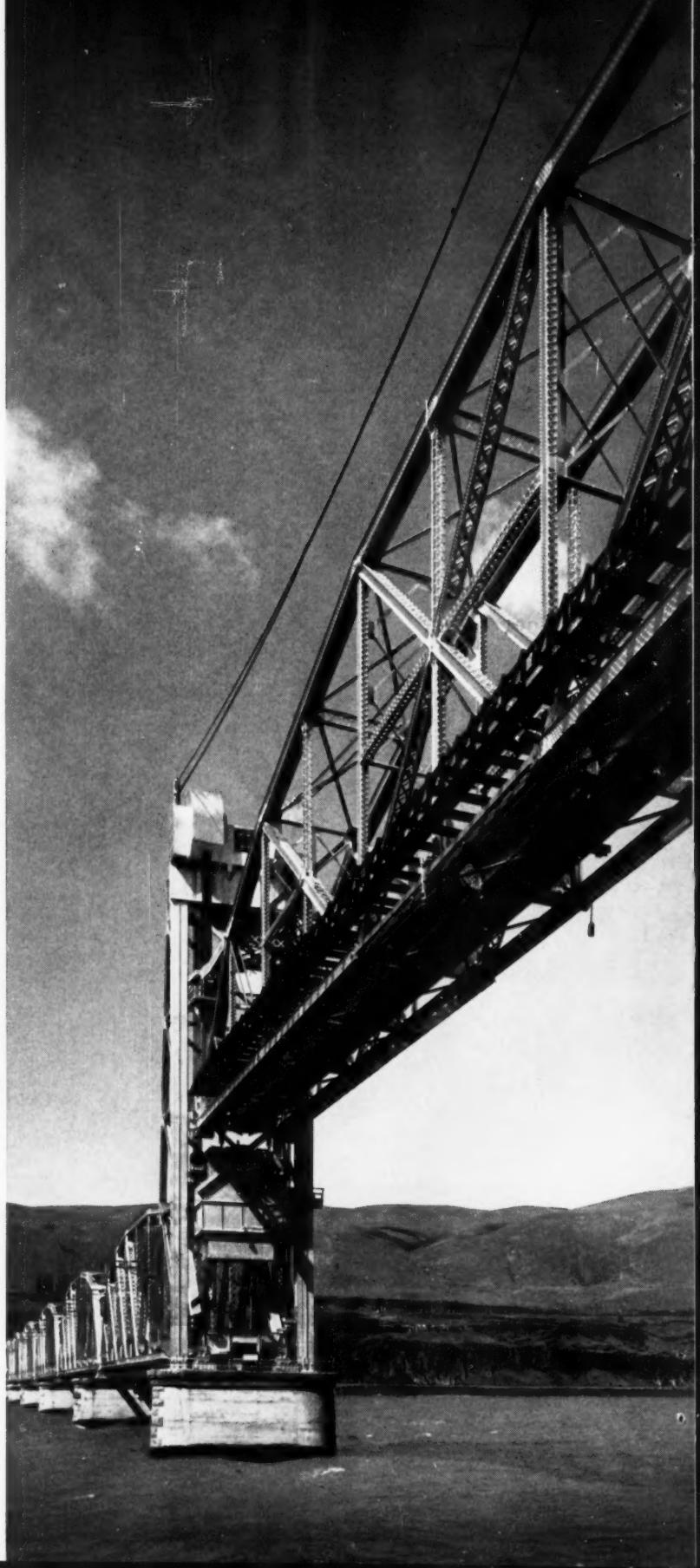
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INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID AGITATORS • FLEXIBLE COUPLINGS
LimiTorque Corporation • Philadelphia

The new lift span on the Celilo Bridge over the Columbia River is being raised to permit river passage. Westinghouse supplied all the major elements of the electrical system, which can raise the span to 75 feet above mean high water in 90 seconds.

Sid Brown, Westinghouse sales representative, at right, is shown discussing approval of electrical control system with Mr. Don Thomas, assistant engineer of structures for Spokane, Portland and Seattle Railway; Mr. Glen Emory and Mr. Ed Bohm, partners of Emory and Bohm, electrical contractors.



Celilo Railway Lift Bridge uses new Westinghouse static skew control

When construction of the Dalles Dam caused the Columbia River to rise closer to the deck of the Oregon Trunk Railway's Celilo Bridge, it became necessary to build a lift span to let river traffic pass beneath. A Westinghouse d-c adjustable-voltage drive, incorporating static skew control, was installed to provide smooth acceleration and a precise regulating system to keep the span level.

Set between two towers, the span is counterweighted and suspended by wire ropes passing over sheaves at the top of each tower. Two Westinghouse d-c mill motors in each tower drive the sheaves and are electrically synchronized by the d-c adjustable-voltage system to keep the span level when operating. The various operations are so interlocked that they must follow a predetermined sequence to assure maximum equipment and personnel safety. The skew control equipment has safeguards against abnormal conditions and requires minimum maintenance.

Westinghouse equipment used on the Celilo Bridge includes: the main d-c drive motors, brakes, motor-generator, control regulating exciters, control board, an operator's console, emer-

gency drive a-c gearmotors and a 225-kva outdoor power center.

Westinghouse, as sole supplier of the coordinated electrical system, assumed undivided responsibility for its overall operation. For further information showing how this complete, single-source supply can benefit you, contact your Westinghouse electrical construction engineer, or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania.

J-94116

Owner: Oregon Trunk Railway (Operated by Spokane, Portland & Seattle Ry.)

Consulting Engineers: Howard, Needles, Tammen & Bergendoff, Kansas City, Mo.

General Contractor: Kansas City Bridge Co., Kansas City, Mo.

Steel Fabricators: Pacific Car & Foundry Co., Seattle, Wash.

Electrical Contractor: Emory and Bohm, Portland, Oreg.

Westinghouse Distributor: Westinghouse Electric Supply Company, Portland, Oreg.

YOU CAN BE SURE...IF IT'S

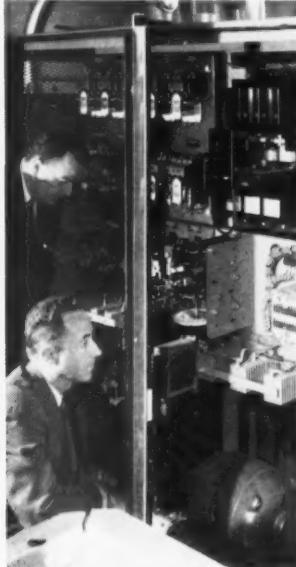
Westinghouse



Over 250 Pages Westinghouse Data in Sweet's Construction File.



Chief operator, Champ King, at Westinghouse control desk. This desk centralizes the starting and stopping of railway traffic, selection of normal, auxiliary or emergency power supply, normal or emergency drive system and control of the lock and lift span.

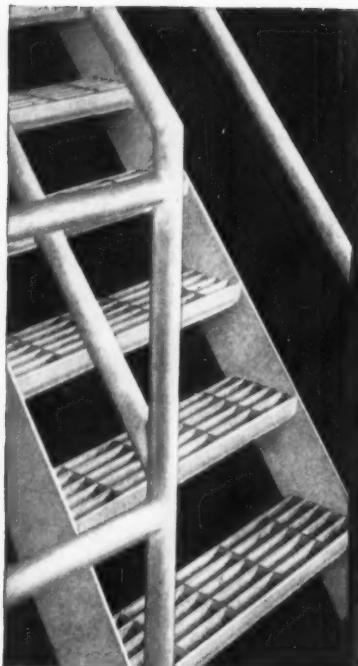


Mr. Brown and Mr. Thomas inspect the interior of the main control cabinet which houses the Magamp* regulator panel and Rototrol[®] elements of the bridge control system.

*Trade Mark



Mr. Bohm and Mr. Thomas examine the Westinghouse 33-hp Type MCA d-c mill motors, designed for heavy intermittent duty, which drive the main span machinery located at top of each tower.



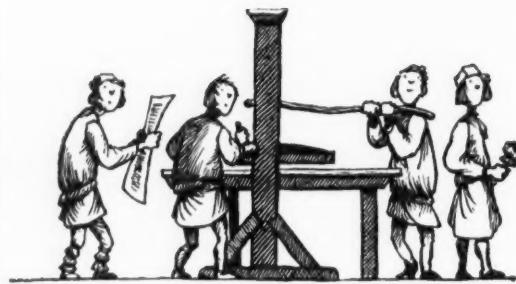
SHUR-SITE TREADS ...the best step for SAFETY

Hendrick Shur-Site Treads have a non-slip surface that insures safety, making them the best choice for your stairs, ladders and fire-escapes. A heavy nosing bar provides reinforcement where the load is greatest. Shur-Site Treads are constructed by a pressure forming process, and so have no angle irons, bolts or rivets to collect dirt and refuse. Their 90% open area lets in plenty of light and air.

Shur-Site Treads are available in standard sizes or in special widths and lengths. They are shipped ready to bolt directly to stair stringers.

Hendrick

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ALABAMA

Donald Mills

Selma, Alabama

¶ Waterworks system, (civil) \$160,000. Client, Town of Loxley, Alabama.

ALASKA

Koen & Hooven

Lansdowne, Pennsylvania

¶ Brewery building, Anchorage, Alaska. (struc.) \$250,000. Client, William F. Koelle Sons, Consulting Engineers.

ARIZONA

F. B. Pacheco Company

Tucson, Arizona

¶ Design paving, curbs, sewers, and storm drains, North First Avenue, Tucson, (civil) \$400,000. Client, North First Avenue No. 2 Improvement District.

CALIFORNIA

August E. Waegemann

San Francisco, California

¶ Eleven-story lift-slab prestressed concrete building, including 72 apartments and three stories of garage parking, San Francisco, Calif.

Mackintosh & Mackintosh

Los Angeles, California

¶ Community center, (struc.) \$500,000. Client, Garrott & Ain, Architects.

Vandament & Darmstedt

San Francisco, California

¶ Atomic Energy Comm. (mech., elec.) \$1 $\frac{3}{4}$ million. Client, Corlett & Spackman. ¶ Presbyterian homes — the Sequoias. (mech., elec.) \$6 million. Client, R. B. Hammond.

¶ Residence Hall Unit 4, University of California, Davis, Calif. (mech., elec.) \$2 $\frac{1}{2}$ million. Client, Kitchen & Hunt. ¶ 1960 winter Olympic games at Squaw Valley. (mech., elec.) \$8 million. Client,

Kitchen & Hunt and Corlett & Spackman. ¶ University of California student union. (mech., elec.) \$2 $\frac{3}{4}$ million. Client, Hardison & Demars.

¶ Morro Bay high school. (mech., elec.) \$900,000. Client, Falk & Booth.

¶ Eastman Kodak building. (mech., elec.) \$2 $\frac{1}{4}$ million. Client, Kitchen & Hunt.

¶ Richmond fire station No. 3. (mech., elec.) \$60,000. Client, Donald Hardison.

COLORADO

William H. Burgwin

Denver, Colorado

¶ Grade separation structure; Colorado Boulevard over Vasquez Boulevard and the C.R.I.&P.R.R. on state highway routes 2 and 3, Adams County, State of Colorado. (struc., civil) \$325,000 (est.) Client, Colorado Department of Highways.

Ripple and Howe

Denver, Colorado

¶ Sewage plant expansion, North Washington Street water and sanitation district, Wilby, Colorado. (civil, struc., mech., elec.) \$340,000. Client, Water and sanitation district.

¶ Waterworks improvements, South Adams County Water and Sanitation District, Derby, Colorado. (civil, struc., mech., elec.) \$250,000. Client, Water and sanitation district.

DELAWARE

Koen & Hooven

Lansdowne, Pennsylvania

¶ De La Warr senior high school, New Castle, Delaware. (struc.) \$2.3 million. Client, E. William Martin & Assoc., Arch.

DISTRICT OF COLUMBIA

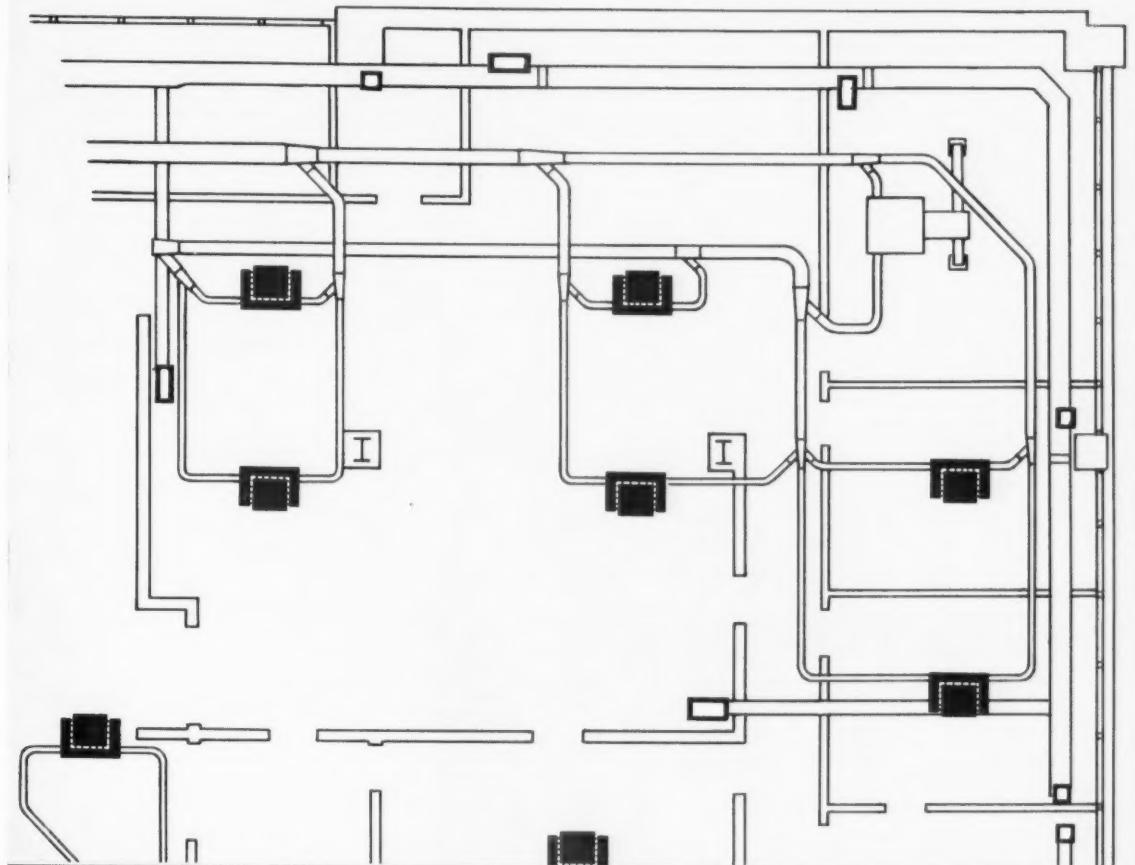
J. Gibson Wilson, Jr.

Washington, D. C.

¶ Two apartment buildings, Washington, D. C. (struc.) \$10 million. Client, Gelman Construction Company.

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The Anemostat All-Air High Velocity distribution system offers many im-

portant advantages. It can be used with smaller than conventional ducts; it can be installed in less time and at less cost. It requires no coils; therefore, there is no leakage, clogging or odor. Anemostat round, square and straightline diffusers with high velocity units are adaptable to a wide

variety of architectural designs.

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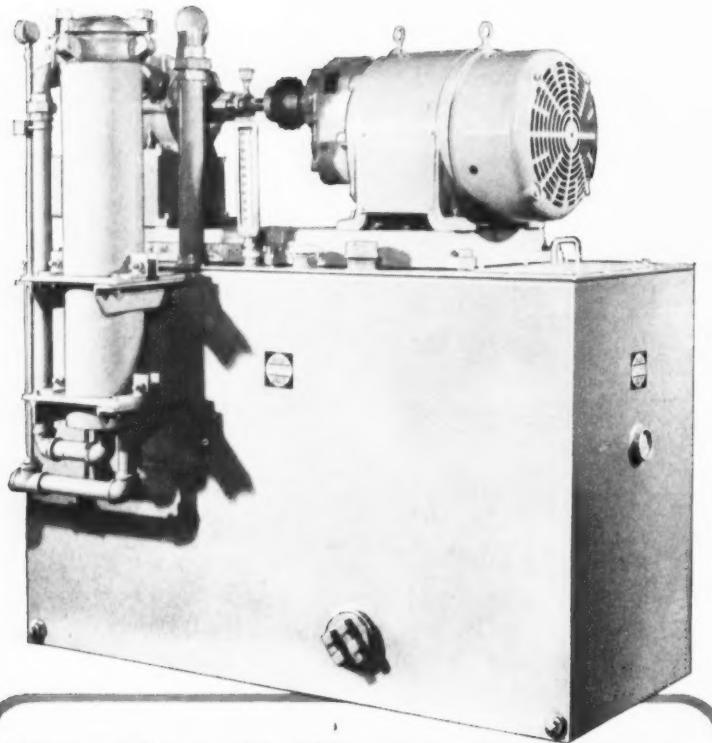
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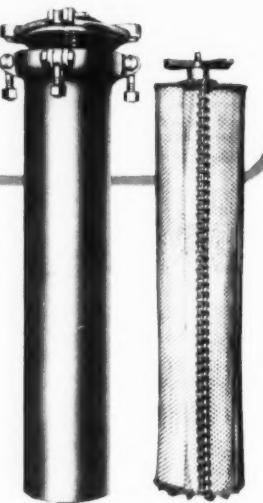


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A number of these compact units are now in operation in the Southeastern plant of a leading producer of synthetic fibers. A Nugent Fig. 1116HA-4L filter is the workhorse of each system which filters and circulates 300 SSU viscosity lubricating oil at the rate of 35 GPM.

The complete units were built by Louis H. Hein Co., Ardmore, Pa. They can be adapted for use with hydraulic oil, coolant, quenching oil, various chemicals and other liquids.

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OILING AND FILTERING SYSTEMS • OILING DEVICES
SIGHT FEED VALVES • FLOW INDICATORS

FLORIDA

Oboler & Clarke

Miami Beach, Florida

† Miami Beach senior high school for Dade County Board of Public Instruction, (struc.) \$1.8 million. Client, Pan-coast, Ferendino, Skells & Burnham, Architects.

† Americana Hotel additions, 167 rooms and garage, Bal Harbour, Florida (struc.) \$1,750,000. Client, Lapidus, Kornblath & Harle, Architects and Tisch Hotels, Inc., owner.

† Fontainebleau Hotel additions, 200 rooms, parking garage, and convention hall, extension of La Ronde Supper Club, Miami Beach, Florida. (struc.) \$4 million (est.) Client, Fontainebleau Hotel Corporation, owners and A. H. Mathes, Architect.

† Boca Raton Motel, Boca Raton, Florida. (struc.) \$2 million. Client, Lapidus, Kornblath & Harle, Architects.

† Pepsi-Cola bottling plant, Melbourne, Florida. (struc., mech., elec.) \$200,000 (building and equipment) Client, National Beverages, Inc.

† Daytona Beach Jai Alai Fronton, Daytona Beach, Florida. (struc.) \$800,000. Client, Francis Walton, Architect and Volusia County Jai Alai Inc., owner.

Bliss Engineering Co., Inc.

Miami Beach, Florida

† Dade County criminal court building, Miami, Florida. (struc.) \$5 million. Client, Coda Associates, Architects, Miami.

ILLINOIS

Crescent Engineering Company

Chicago, Illinois

† Warehouse and office, 150,000 sq ft, air conditioned. (elec.) \$200,000 (elec.). Client, Graybar Electric Company.

INDIANA

Hannan, Meek & Cordill

Indianapolis, Indiana

† New church for Little Flower parish. (civil, struc., mech., elec.) \$500,000. Client, Archdiocese of Indianapolis.

† Phase 1 of new church for St. Andrew's parish, Indianapolis. (civil, struc., mech., elec.) \$150,000. Client, Archdiocese of Indianapolis.

† Extension of 34th Street sewer, Emerson Avenue to Arlington Avenue, Indianapolis, Indiana. (civil, struc.) \$300,000. Client, Sanitary District of Indianapolis, Board of Sanitary Commissioners.

† Remodel Colonial Savings & Loan Association building. (civil, struc., mech., elec.) Client, Federal Savings & Loan Association.

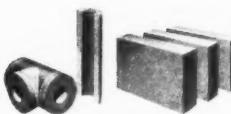
† Alverna Chapel extension, Indianapolis, Indiana. (civil, struc., mech., elec.) \$40,000. Client, OFM.

IOWA

R. W. Booker & Associates

St. Louis, Missouri

† Soybean oil extraction expansion, Ma-



FOAMGLAS® INSULATION / waterproof, vapor-proof, strong, can't burn, acid-proof, vermin-proof, dimensionally stable



"Here's how **FOAMGLAS®** insulation helped us build a bigger warehouse for \$50,000 less"

—H. J. Goelzer, Vice President, Plymouth Cold Storage

Plymouth Cold Storage Company saved 3 months time and \$50,000 building a new 6-million pound cheese warehouse—largely on the strength of FOAMGLAS roof and wall insulation. Vice President H. J. Goelzer tells how:

"Conventional construction would have given us a new 5-million pound capacity warehouse in 6 months time at a cost of \$125,000. But we found a new type of warehouse construction that halved building time and gave us an extra million pounds capacity for a total cost of only \$75,000. The secret was a prefabricated Butler Building frame plus FOAMGLAS to double as insulation and structural material in roof and walls."

"Nothing but FOAMGLAS could have done this job for us. Its great compressive strength, incombustibility and absolute dimensional stability made it an ideal structural component. And since FOAMGLAS is moisture-

proof, it insures constant insulating value for the life of our warehouse. FOAMGLAS even gave us vapor-tight construction without a separate vapor barrier. It's vermin-proof, too—important in a cheese warehouse."

This is just one of many ways FOAMGLAS insulation can make food processing and storage facilities function better, cost less, last longer. Our Low Temperature Insulation brochure contains complete data. Write Pittsburgh Corning Corp., Dept. R-49, One Gateway Center, Pittsburgh 22, Pa. In Canada: 3333 Cavendish Blvd., Montreal, Quebec.



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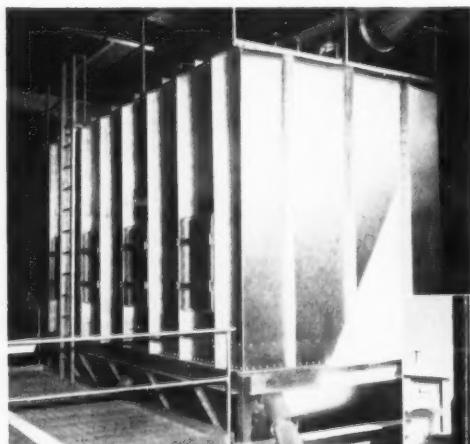
Much has been done about air pollution during the last 40 years, but a new wave of awareness to its widespread dangers finds government authorities, scientists and businessmen searching for more efficient, more complete methods of controlling dust, fumes, smoke, and odors.

Norblo's experience of nearly 50 years in the removal of injurious industrial air contaminants has been extensive in most industries. The three major types of collectors illustrated are recommended for the work each is best suited to perform. High recovery at low operating and maintenance costs is assured by Norblo's careful application check and guarantee of performance. All components of Norblo collecting systems are made in our own shops, including the exhaust fans.

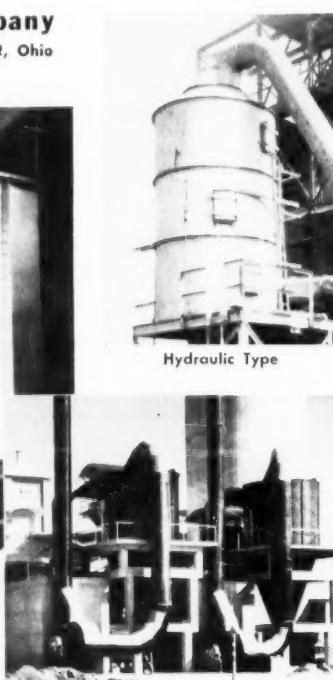
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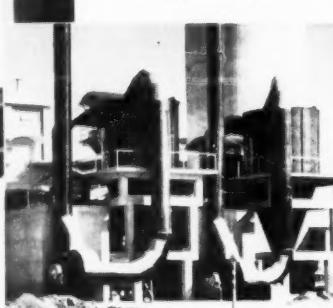
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son City, Iowa. (mech.) \$225,000. Client, North Iowa Cooperative Processing Association, Mason City, Iowa.

Moore & Bouse

Cedar Rapids, Iowa.

¶ Mercy Hospital convalescent home, Cedar Rapids, Iowa. (mech., elec.) \$520,000. Client, Brown & Healey, Arch. ¶ Coe College dormitories, Cedar Rapids, Iowa. (mech., elec.) \$1,250,000. Client, Brown & Healey, Architects.

¶ Merchants National Bank building, Cedar Rapids, Iowa. (mech., elec.) Client, Brown & Healey, Architects.

¶ Calvin United Presbyterian Church, Cedar Rapids, Iowa. (mech., elec.) Client, Crites, Peiffer & McConnell, Architects.

¶ Iowa-Illinois Gas & Electric Company, Cedar Rapids, Iowa, office air conditioning. (mech., elec.) Client, Owner.

¶ Our Savior Lutheran Church, Cedar Rapids, Iowa. (mech., elec.) \$80,000. Client, Thorson & Brom, Architects.

¶ First Christian Church, Iowa City, Iowa. (mech., elec.) \$100,000. Client, Brown & Healey, Architects.

Federal Engineering Company

Davenport, Iowa

¶ Sewage treatment plant and extensions to sewerage system, Wilton, Iowa. (civil) \$380,000. Client, Wilton, Iowa.

KENTUCKY

C. W. Batey

Hopkinsville, Kentucky

¶ Henderson County schools, Henderson, Kentucky. (mech.) \$110,000. Client, Roberts & Johnson.

¶ American National Bank, Bowling Green, Kentucky. (mech., elec.) \$60,000. Client, Joseph Wilk.

¶ United States Post Office. (mech., elec.) \$120,000. Client, the General Services Administration.

¶ Courthouse, Nardinsburg, Kentucky. (mech.) \$30,000. Client, Roberts & Johnson.

¶ Motel, Owensboro, Kentucky. (mech., elec.) \$50,000. Client, Max Bisson.

¶ Library, Owensboro, Kentucky. (mech., elec.) \$75,000. Client, Max Bisson.

J. Stephen Watkins and Robert E. Martin
Louisville, Kentucky

¶ Sanitary sewer system and primary type sewage treatment plant, lift stations, force mains, Shively, Kentucky. (civil) \$4,650,000. Client, City of Shively, Ky.

MARYLAND

McGeorge-Hargett & Associates

Cleveland, Ohio

¶ Carling Brewing Company, Baltimore, Maryland. (civil, struc., mech., elec.) \$12 million. Client, Carling Brewing Co.

Van Reuth & Weidner, Inc.

Baltimore, Maryland

¶ Sewage treatment plant, sewage pumping station, and force main, Centreville, Maryland. (struc., civil, mech., elec.)

When it comes to Clock and Program Systems...



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TRADEMARK

STANDARD, the world's leading manufacturer of this equipment, offers you the *only* clock and program systems with *all* these features:

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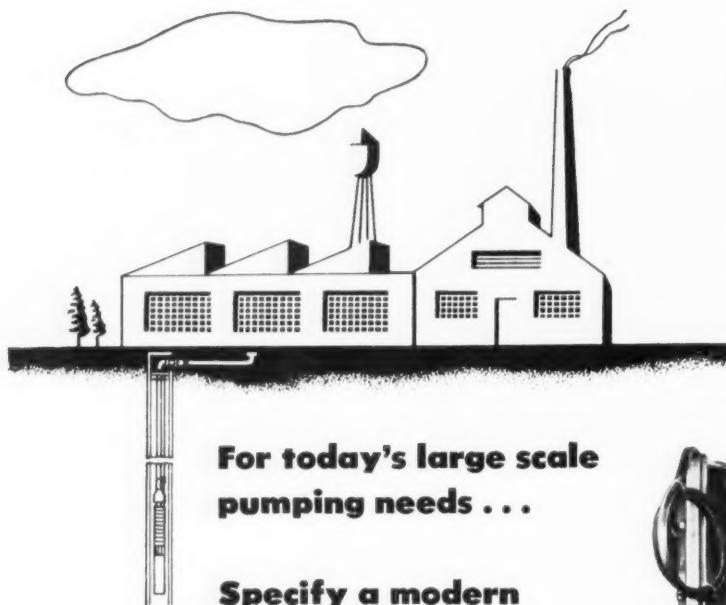
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SUMO SUBMERSIBLE PUMP

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What's more, installation is exceedingly simple. The unit is simply attached to the end of the discharge pipe and lowered into the well casing. There are no drive shafts or bearings or alignment problems to give trouble. And, because the pump is coupled directly to the motor, more efficient use of power is obtained.

Sumo offers technical advice and assistance in selecting and applying submersible pumps to your needs. There's no obligation.

BULLETIN B-1000

has full information on Sumo high-capacity pumps. Call or write for your copy. Also request data on Sumo extra high capacity 120 hp units.



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for pumping water containing high percentages of solids. Write BULLETIN B-1100 for details on these rugged, heavy duty pumps designed for drainage, flooding or general service pumping.



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Warehouse Stocks: Stamford • Dallas • San Francisco
The Complete Line from 1/3 hp to 120 hp.

\$200,000. Client, Town commissioners of Centreville, Maryland.

J. Gibson Wilson, Jr.
Washington, D. C.

† Wheaton Plaza regional shopping center, Wheaton, Maryland. (struc.) \$20 million. Client, A. L. Anderson, Architect.

‡ Office building at National Institute of Health, Bethesda, Maryland. (struc.) \$9 million. Client, Keyes, Lethbridge & Condon and Richard Collins, Associated Architects.

§ Springbrook High School, Silver Spring, Maryland. (struc.) \$2.5 million. Client, Johannes & Murray, Architects.

Lee Kendrick & Associates
Arlington, Virginia

¶ St. Martin's Church, Annapolis, Maryland, (mech., elec.)

|| Replacement of steam mains, areas 1 and 3, Andrews Air Force Base. (mech., elec.) Client, Andrews AFB.

|| Hangar 180, Andrews Field. (elec.) Client, Mrs. Rhodock, Architect.

|| Addition to heating plant, Andrews AFB. (mech.) Client, U.S. Army Corps of Engineers.

MASSACHUSETTS

Kenneth R. Warrington
Wellesley Hills, Massachusetts

|| High pressure steam plant. (civil, struc., mech., elec.) Client, Norton Company, Worcester, Massachusetts.

MINNESOTA

G. R. Willet & Company
Chicago, Illinois

|| Electronic security system. (elec.) \$100,000. Client, Southdale Shopping Center, Minneapolis, Minnesota.

MISSISSIPPI

Lester Engineering Company
Jackson, Mississippi

|| Study of 27-square mile sanitary drainage basin for proper collection and disposal of sewage, Hanging Moss Creek Basin. (civil) Client, City of Jackson.

Harza Engineering Co. —
Lester Engineering Co.
Jackson, Mississippi

|| 37,000-acre reservoir for water supply, recreation. (civil) \$24 million. Client, Pearl River Valley Water Supply District.

MISSOURI

R. W. Booker & Associates
St. Louis, Missouri

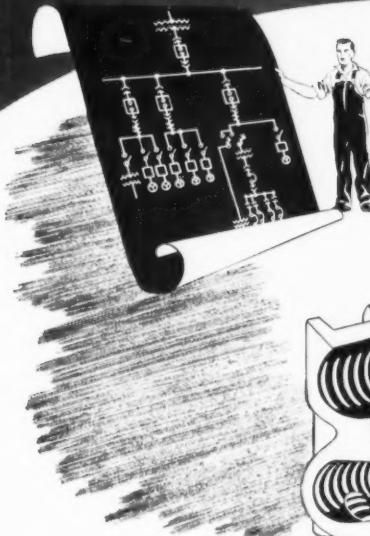
|| Chain of Rocks low water dam. (civil) \$6 million. Client, U. S. Army Corps of Engineers, St. Louis, Mo.

|| Sewers, St. Louis, Missouri. (civil) \$560,000. Client, Metropolitan St. Louis Sewer District.

|| Roads, State of Missouri. (civil) \$70,000. Client, State of Missouri Highway Department, Jefferson City, Mo.

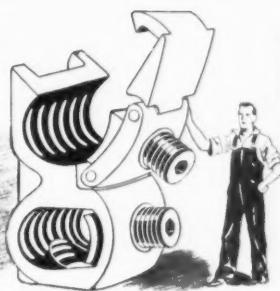
|| Bridge, St. Louis County, Missouri.

ONE O.Z. FITTING DOES THE WORK OF 32

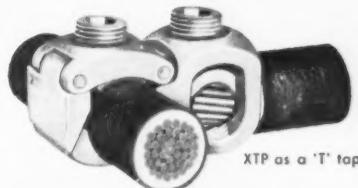


32 connector sizes needed on this job!

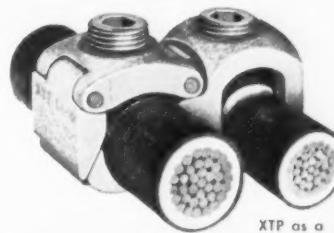
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XTP as a 'T' tap



XTP as a parallel tap



High-strength Bakelite insulating covers for XTP fittings.
Compact, install with stainless spring clips, no taping.

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One typical XTP connector replaces up to 32 different parallel or tee connectors because each XTP accommodates a wide range of wire sizes. All told, the XTP line of but 25 connectors will receive over 400-wire size combinations!

For either tee or parallel taps, just snap special hinged clamp over main and tighten the connector permanently in place—positive contact is assured. When you're ready to connect the tap, simply insert wire in tap end of connector. A wrench-turn or two, the job's done!

25 CONNECTOR SIZES do practically all tap jobs.

- Accommodate over 400 combinations of wire sizes
- Fit wire from #8 to 1,000,000 CM

HINGED CONSTRUCTION for quick installation.

SPRING STEEL LOCK WASHERS (tin plated) maintain pressure.

- Hold resiliency—assure permanent connection

PRESSURE PLATES designed for maximum contact and grip.

- Serrated for firm grip
- Can not rotate during installation

HIGH STRENGTH, HIGH CONDUCTIVITY.

- High conductivity copper alloy for body
- Extra strength copper alloy for pressure plates and hinged parts

Get these combination fittings from your wholesaler now...and put an end to bulky assortments of tap connectors.



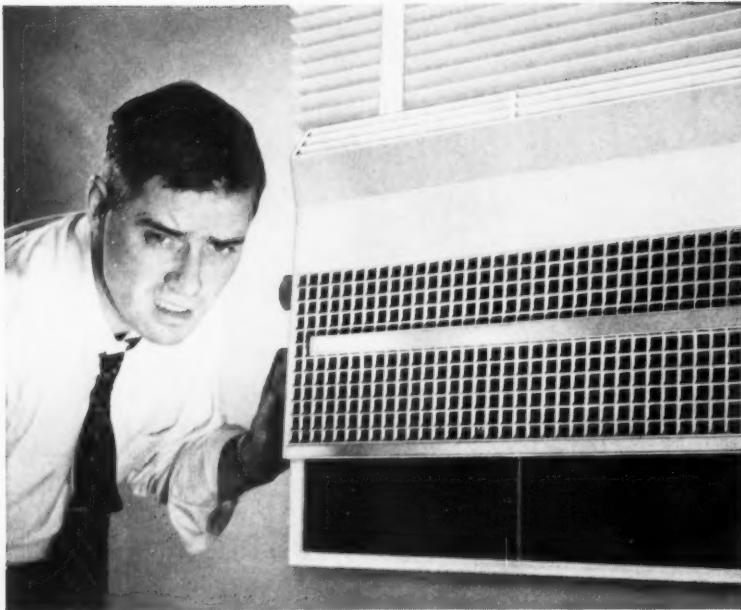
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GO AHEAD... explain nuisance tripping to him

Heat's on, conditioner's out. How come?

Some annoying power interruptions are due to inadequate wiring. A vast number are due to nuisance tripping of circuit breakers or nuisance fuse blowouts.

Fuses and many circuit breakers operate on the basis of heat. They are sensitive to heat from within the circuit and without. Thus, on hot days thermal protectors are often near the tripping point even though the circuit is not fully loaded. As heat builds up, nuisance tripping results.

Heinemann hydraulic-magnetic circuit breakers *ignore heat*—respond only to *current* (amperage) which is the true determinant of electrical load. These circuit breakers will carry the full, safe capacity on the hottest days. Nuisance tripping just doesn't occur.

In Heinemann circuit breakers, actuation is entirely magnetic; inverse time delay is provided by hydraulic means. When protection is needed, interruption is fast. When the circuit is safe, power stays ON.

For consulting engineers, the full story is given in an informative booklet, Manual 101: "What You Should Know About Circuit Breakers." Write for your copy.

HEINEMANN

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Circuit breakers



SA 1410

(struc.) \$60,000. Client, St. Louis County Highway Department, Clayton, Mo.

S. J. Callahan & Company

Kansas City, Missouri

¶ Six split-level parking station, Kansas City, Missouri. (civil, struc.) \$200,000. Client, Mutual Auto Parks, Inc.

NEW JERSEY

V. L. Falotico & Associates

Brooklyn, New York

¶ Morristown Hospital new addition and alterations, Morristown, New Jersey. (mech., elec.) \$1,750,000. Client, Ferrenz & Taylor, Architects.

H. A. Martin Associates

New York, New York

¶ Heating and air conditioning, Ocean County office building, Toms River, New Jersey. (struc., mech.) \$40,000. Client, J. G. Phillips, Architect.

¶ Reade Manufacturing Co., plant office addition, structural and heating. (struc., mech.) \$50,000. Client, J. G. Phillips, Architect.

Victor J. Lo Pinto Associates

Long Branch, New Jersey

¶ Soil analysis of beach fill material for shore protection, Ocean City, New Jersey. (civil) \$2 million. Client, State of New Jersey Department of Conservation and Economic Development; Navigation Bureau.

Andre H. Vanderzanden

Oradell, New Jersey

¶ Holy Rosary School, Edgewater, New Jersey. 3-story addition, reinforced concrete and structural steel frame. (struc.) \$200,000. Client, James J. Kennedy, Architect.

Robert R. Papp, P.E.

White Plains, New York

¶ Phthalic Anhydride plant, Elizabeth, New Jersey. (struc.) \$300,000. Client, Reichhold Chemicals, Inc., William Weigle, Architect.

NEW MEXICO

J. L. Breeze & Associates

Santa Fe, New Mexico

¶ Student Union building, New Mexico State University, Las Cruces, New Mexico. Heating, air conditioning, plumbing. (mech.) \$750,000. Client, Wolgamood & Millington, Architects, Santa Fe, N.M.

NEW YORK

Blitman & Tischler

New York, New York

¶ 20-story building and penthouse going over East River Drive. (struc., civil) Client, Gross Bros.

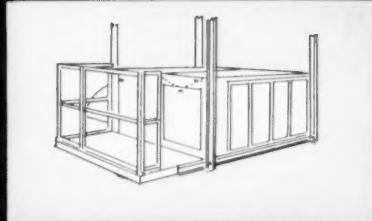
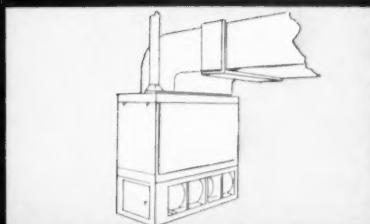
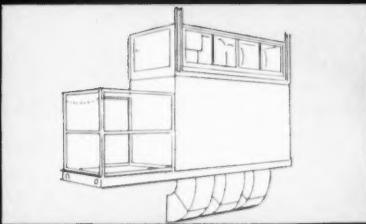
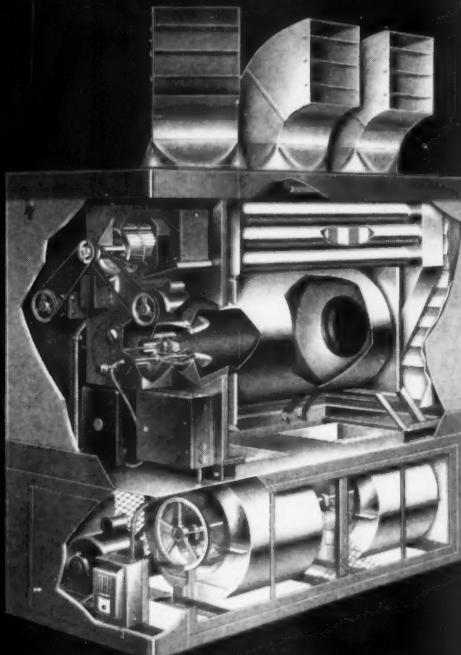
Charles M. Shapiro, P.E.

Brooklyn, New York

¶ Four-story brick and steel building, extension for manufacturing, storage, and trucking facilities, Brooklyn, New York.

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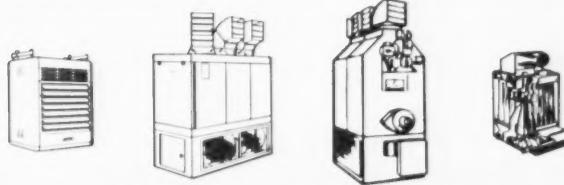
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This leading Western high school is particularly noteworthy for the flexibility of its design.

Planned for easy expansion to meet growing needs, the design allows for adaptation to changing educational philosophy — and does it in a practical, economical way.

In keeping with the extreme efficiency of the building, the architect and consulting engineer specified a Stromberg-Carlson school communications system, realizing that this company's 65 years of specialization in sound offer outstanding benefits.

• **Flexibility in the system, as in the school itself.**

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(struc., civil) \$280,000. Client, Manufacturers Realty Corporation.
¶ One-story fireproof factory building, 10,000 sq. ft. Brooklyn, New York. (struc., civil, mech.) \$60,000. Client, Antico Manufacturing Corporation.

V. L. Falotico & Associates

Brooklyn, New York

¶ St. Aidan's church and convent addition, East Williston, Long Island, New York. (mech., elec.) \$1 million. Client, John O'Malley, Architect.

¶ Our Lady of Fatima church and rectory, Jackson Heights, Long Island, New York. (mech., elec.) \$1 million. Client, Beatty & Berlenbach, Architects.

¶ Stella Maris high school and convent, Rockaway Beach, Long Island, New York. (mech., elec.) \$2 million. Client, Beatty & Berlenbach, Architects.

¶ Public School 128, Manhattan, New York City. (mech., elec.) \$3 million. Client, Chapman, Evans & Delehanty, Architects.

¶ Meadowbrook Hospital alteration and new addition, Meadowbrook, Long Island, New York. (mech., elec.) \$1 million. Client, Eggers & Higgins, Architects.

Martin Isaacs

New York, New York

¶ New building for Salvation Army, Bronx, New York. (struc.) \$1 million. Client, Joseph Mitchell, Architect.

Robert R. Papp, P.E.

White Plains, New York

¶ Industrial building, Mamaroneck, New York. (complete design) \$160,000. Client, Harrison Structural Iron Works, Inc.

¶ Residence, Yonkers, New York. (complete design) \$30,000. Client, Raymond J. O'Neill.

¶ Factory and offices, Mount Vernon, New York. (struc.) Client, Francis Pinto, Architect.

¶ Industrial building, Mount Vernon, New York. (complete design) \$50,000. Client, Joseph L. Pirro.

¶ Industrial building, Mount Vernon, New York. (complete design) \$60,000. Client, United Iron & Steel Fabricators.

¶ Firehouse, Bedford Hills, New York. (struc.) \$250,000. Client, Matthew J. Warshauer, Architect.

¶ Residence, Mamaroneck, New York. (struc.) \$60,000. Client, Matthew J. Warshauer, Architect.

¶ Industrial building, Brooklyn, New York. (struc.) \$300,000. Client, William Weigle, Architect.

NORTH DAKOTA

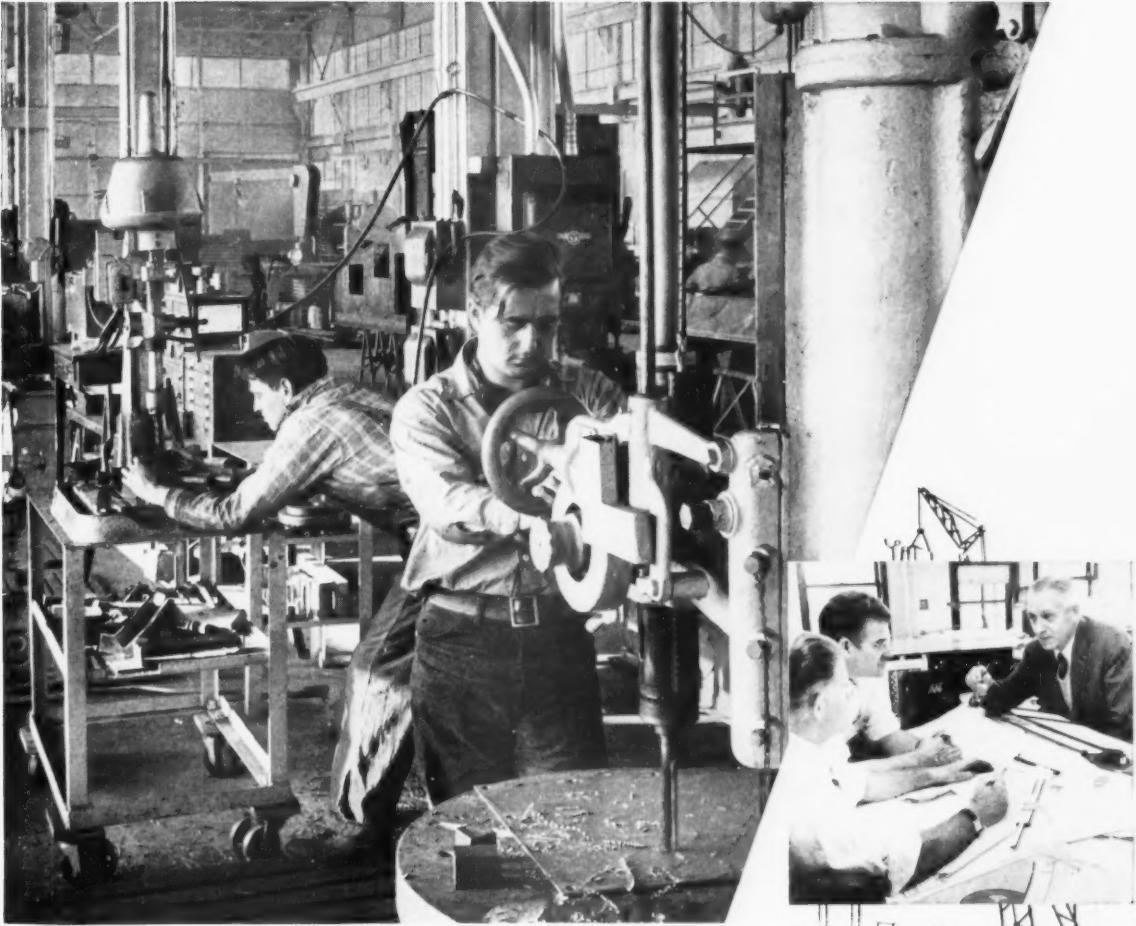
North Central Engineers

Jamestown, North Dakota

¶ Sewer and water main extensions. (civil) \$400,000. Client, City of Jamestown, North Dakota.

¶ Curb and gutter and paving. (civil) \$160,000. Client, City of Gackle, North Dakota.

¶ Curb and gutter and paving; sewer and water main extensions. (civil) \$225,000. Client, City of Hebron, N.D.



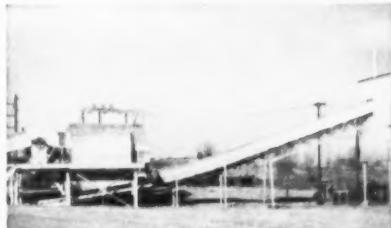
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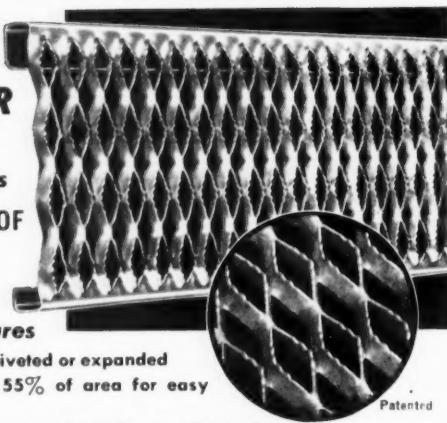
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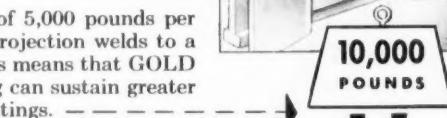
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The QUALITY GRATING for Heavy Duty Applications

- ★ 3/8" projection weld nugget for greater rigidity and strength
- ★ Vertical alignment of the main load bar assured
- ★ All bars are load carrying bars including secondary bars
- ★ Anti-skid pattern

PROJECTION WELD

Each secondary load bar (A), as projected welded to the primary load bar (B) has a shear strength of 5,000 pounds per weld. There are 28 such projection welds to a square foot of grating. This means that GOLD NUGGET Welded Grating can sustain greater shock loads than other gratings.



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For the complete details of these revolutionary new gratings, write for new catalogs today. Distributors in all principal cities. Consult the yellow pages in your phone book under "GRATING".

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SINCE 1914

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OHIO

Clauer Associates
Wooster, Ohio

† Outdoor swimming pool, 16,000 sq ft; wading pool, 1000 sq ft. Lounge, dressing rooms, offices, utility rooms, sun deck, and parking area. (struc., civil, mech., elec.) \$200,000. Client, Surf 'N' Sun Club, Akron, Ohio.

George M. Neuffer

Dayton, Ohio

† Bowling alley, Wilmington, Ohio. 18 lanes, structural steel and masonry bearing wall, longspan joists. (struc., civil) \$225,000. Client, Owner's agent.

† New factory building, One-story, structural steel, longspan joists, masonry bearing walls, aluminum curtain walls, 22,000 sq ft. (struc., civil) \$220,000. Client, Owner's agent.

Wilbur M. Shober

Cleveland, Ohio

† Confidential work for U.S. Navy. (elec.) Client, Federal government.

McGeorge-Hargett & Associates

Cleveland, Ohio

† Office; research and factory building. (civil, struc., mech., elec.) \$3 million. Client, Yoder Company.

† Materials research laboratory, Cleveland, Ohio. (civil, struc., mech., elec.) \$1 million. Client, N.A.S.A.

† Research laboratory, Delaware, Ohio. (civil, struc., mech., elec.) \$350,000. Client, U.S. Department of Agriculture.

† Six-story metallurgy building. (civil, struc., mech., elec.) \$2 million. Client, Case Tech, Cleveland, Ohio.

† Six-story library. (mech., elec.) \$3 million. Client, Case Tech, Cleveland, Ohio.

Herman Blum, Consulting Engineers, Inc.
Dallas, Texas

† Service and warehouse building, Federated Department Stores, Inc., Cincinnati, Ohio. (mech., elec.) \$270,000. Client, Betz & Bankemper, Architects, Covington, Kentucky.

† Shillito Department Store, Tri-County shopping center, Cincinnati, Ohio. (mech., elec.) \$670,000. Client, Cyrus L. Baxter, Architect.

PENNSYLVANIA

Kain & Hooven

Lansdowne, Pennsylvania

† School and chapel building, Cheltenham, Pennsylvania. (struc.) \$230,000. Client, Peter F. Getz, Architect.

† St. Jane Frances de Chantal Roman Catholic church, Easton, Pennsylvania. (struc.) \$400,000. Client, Peter F. Getz, Architect.

† St. Clement's Roman Catholic church, Philadelphia, Pennsylvania. (struc.) \$500,000. Client, Peter F. Getz, Arch.

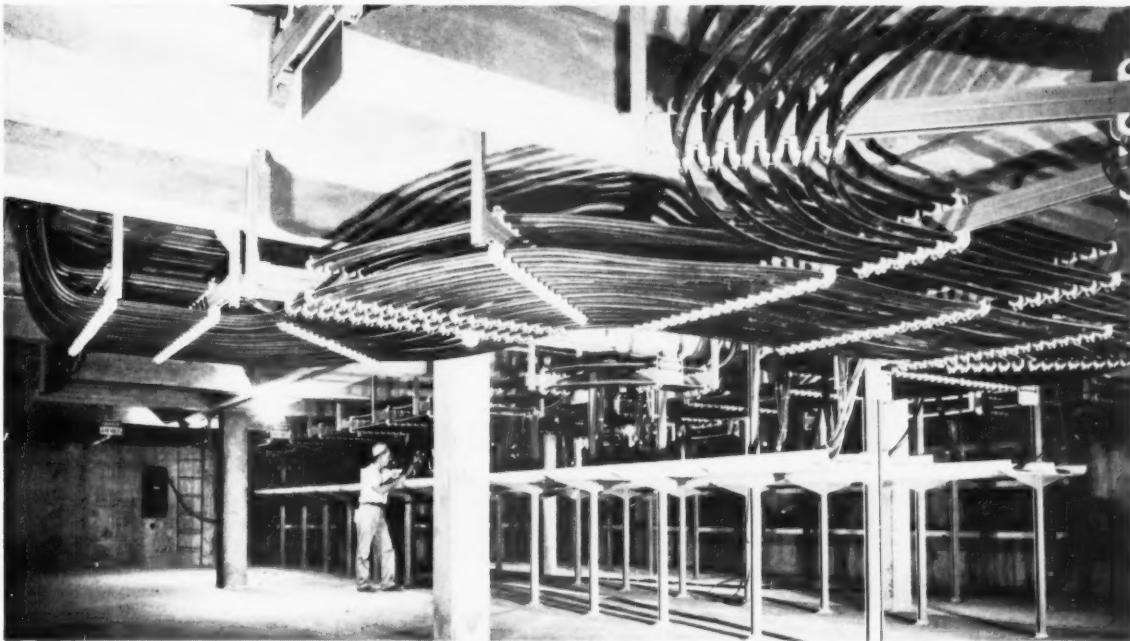
Walker-Yeomans Associates, Inc.

Philadelphia, Pennsylvania

† Manufacturing building, 100,000 sq ft, one-story, Lansdale, Pennsylvania.

More Than 70 Miles of Cable in This New Plant

New National Potash Company plant, near Carlsbad, N. M., covers 10 acres, produces up to 800 tons of potash concentrate daily.
 General Contractor: Stearns-Roger Manufacturing Co., Denver, Colorado
 Electrical Distributor: Fairmont Supply Co., Fairmont, West Virginia
 Electrical Contractor: Service Electric Co., Carlsbad, N. M.



Banks of 480-volt feeder cable converge under ceiling in No. 2 substation basement of new National Potash Company plant. Like all the cable used in this installation, it's Roebling and made to withstand the tough corrosive conditions.

And It's All Roebling Because...

We're in Carlsbad, New Mexico, at National Potash Company's new \$12,000,000 refinery. More than 375,000 feet of cable were installed in this plant by Service Electric Company, Carlsbad, New Mexico, the contractor. And all of it is Roebling!

Let Mr. Harvey Mathews, vice president of Stearns-Roger tell you some of the reasons why: "Cable specifications required an insulation that was tough and durable, because here, as in all plants of this type, there is the ever-present factor of corrosion caused by atmospheric moisture being absorbed into the salt dust, forming brine, as well as the corrosive action of the chemicals present. Obviously," continues Mr. Mathews, "we had to have wire and cable insulation of superior quality throughout, to protect the plant's elec-

trical system from insidious failure."

Every Roebling cable and wire is built to last—and last some more—even under the severe conditions prevailing in applications like this potash refinery! Roebling never takes short cuts. Each

Roebling wire and cable is made with scrupulous care to assume maximum life and service. And this extra pride of workmanship means no premium in price. What's more, Roebling Technical Service—based on generations of practical experience—is always freely available to help you get the most from the Roebling products you use.

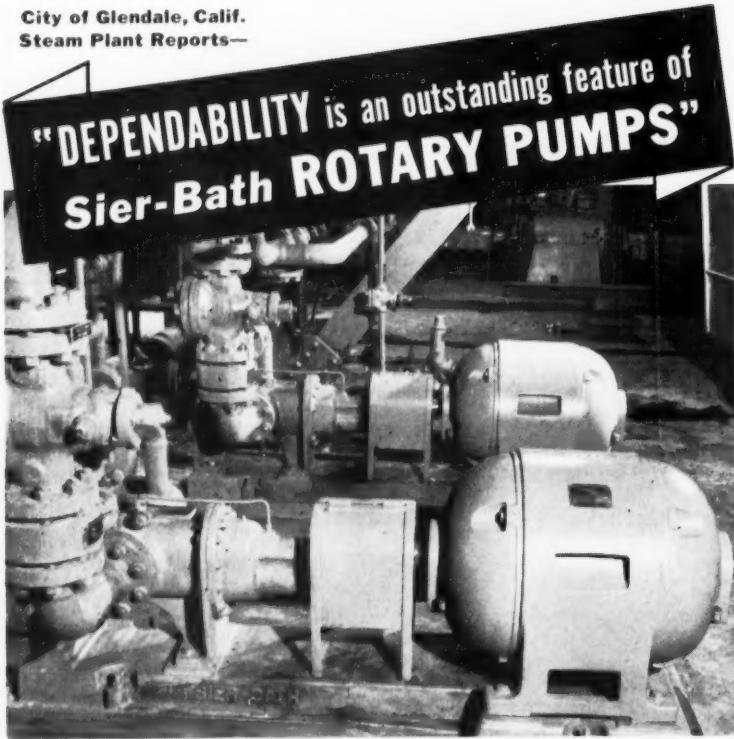
Next time—take the headaches out of the job by specifying Roebling all the way! For Roebling extra-quality wire and cable see your Roebling Distributor or write: Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.



Harvey Mathews, vice president, Stearns-Roger Manufacturing Company, discusses building plans with Jack Lorenz, resident engineer.

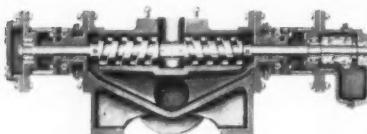
ROEBLING 
 Branch Offices in Principal Cities
 Subsidiary of The Colorado Fuel and Iron Corporation

**City of Glendale, Calif.
Steam Plant Reports—**

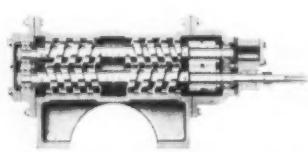


In 1953, two Sier-Bath Screw Pumps and one Hydrex Gear Pump were installed on a best-bid basis and have continued to save money through years of continuous service, with low maintenance and operating costs. The Screw Pumps are used to pump fuel oil to heaters at 125°F and 450 psi. Hydrex Pump circulates oil in heaters, when screw pumps are not operating.

Sier-Bath SCREW PUMPS



External Gear and Bearing Bracket Type for non-lubricating liquids and semi-liquids



Internal Gear and Bearing Type for lubricating liquids and semi-liquids

Sier-Bath Screw Pumps maintain high volumetric efficiency because "Dual-Controlled" precision rotor design prevents rotor-to-rotor or rotor-to-casing contact—provides a continuous flow without pulsation, hammering or vibration . . . without strains, misalignment and wear on rotors, shafts, bearings and gears.

Result: Dependable, uninterrupted pumping service—less maintenance—easier servicing—longer pump life—lower overall pumping costs.

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Sier-Bath ROTARY PUMPS



Screw Pumps



Georex® Pumps



Hydrex® Pumps

Founded 1905

Mfrs. of Precision Gears, Rotary Pumps, Flexible Gear Couplings

Member A.G.M.A.

(mech., elec.) Client, Lansdale Tube Div. of Philco Corporation.

Gatter & Diehl

Harrisburg, Pennsylvania

¶ Students' activities building; new library; Carnegie Institute of Technology, Pittsburgh, Pa. (mech., elec.) \$410,000.

¶ Cumberland County courthouse, Carlisle, Pa. (mech., elec.) \$215,000.

¶ Highway testing laboratory building, Harrisburg, Pa. (elec.) \$47,000. Client, State of Pennsylvania.

¶ New junior high school, City of Lancaster, Pa. (mech., elec.) \$200,000.

¶ Bell Telephone Co. of Pennsylvania exchange building, Williamsport, Pa. (mech., elec.) \$190,000.

¶ New P.S.E.A. building, Harrisburg, Pa. (mech., elec.) \$245,000.

¶ Junior high school, Schilington, Pa. (mech., elec.) \$315,000.

¶ Dormitory building and electrical distribution, Millersville State Teachers College. (mech., elec.) \$118,000.

TEXAS

Halsey & Royer

San Antonio, Texas

¶ Grace Lutheran church addition. (mech., elec.) \$375,000. Client, Edwin Nicholson, Architect.

¶ Sequin high school addition. (mech., elec.) \$175,000. Client, Julian & White, Architects.

¶ Yoakum high school addition. (mech., elec.) \$88,000. Client, Di Stefano & Cerna, Architects.

¶ Highland Park Lutheran Church educational building. (mech., elec.) \$240,000. Client, Malcolm G. Simons, Arch.

¶ E. J. Burke duplexes heating. (mech.) \$37,500. Client, Owner.

¶ St. Andrews Methodist Church. (mech., elec.) \$200,000. Client, Harvey P. Smith, Architect.

¶ Mission Valley Mills, Inc., shipping room addition. (mech., elec.) \$215,000. Client, Owner.

¶ Mission Valley Mills, Inc., new substation. (elec.) \$80,000. Client, Owner.

¶ Kallison Properties, Inc., office building. (mech., elec.) \$250,000. Client, Henry L. Fox, Architect.

Reaves & Gregory

Fort Worth, Texas

¶ Sewage treatment plant, water tank, water lines, and sewer lines. (civil) \$375,000. Client, Granbury, Texas.

¶ Improvements to electrical distribution system. (elec.) Client, Granbury, Texas.

¶ Street and drainage improvements. (civil) \$675,000. Client, City of River Oaks, Texas.

¶ Sewage lift station. (civil) Client, City of Arlington, Texas.

¶ Sewage treatment plant and sewage collecting system. \$145,000. Client, City of Everman, Texas.

Raymond L. Jenkins

Houston, Texas

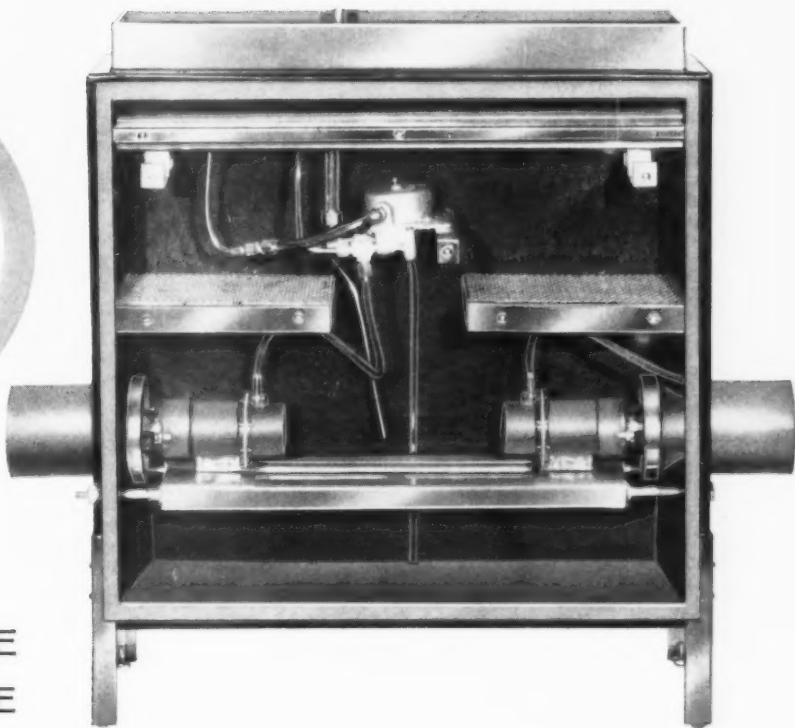
¶ Methodist Hospital addition, Texas Medical Center, Houston, Texas. (mech.,

NEW

CON-VOL EQUIPPED HIGH VELOCITY UNITS

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VOLUME
UNDER ALL
CONDITIONS

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FEATURE
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PRECISION
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Yes sir, Dart Unions cut costs because

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3. They stay tight — damage no property, spoil no work.
4. They can be used over and over again.

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- Each Dart is individually vacuum-tested
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PITTSBURGH 22 • BOSTON 10 • ROME, GEORGIA**

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elec.) \$8 million. Client, Milton B. McGinty, Architect.

Herman Blum, Consulting Engineers, Inc.

Dallas, Texas

¶ Dallas theater center, Dallas, Texas. (mech., elec.) \$200,000. Client, Frank Lloyd Wright, Architect.

¶ Sulphur Springs high school, Sulphur Springs, Texas. (mech., elec.) \$85,000. Client, White and Feinberg, Architects.

¶ El Paso airport terminal building and hangar building, El Paso, Texas. (mech., elec.) \$400,000. Client, Garland & Hilles, Architects.

¶ Doctor's office building, Dallas, Texas. (mech., elec.) \$350,000. Client, Jacob E. Anderson, Architect.

Palmros Engineering Company

Fort Worth, Texas

¶ 200-unit trailer park. (civil, struc., mech., elec.) \$220,000. Client, Beck, Beck & Beck, owners.

¶ Hotel unit addition. (struc., mech., elec.) \$2.5 million.

VERMONT

Otto E. Kuhl, P.E., Joseph A. Kestner, Jr.
Troy, New York

¶ Sewage treatment and intercepting sewer, Shelburne, Vermont. (civil) \$60,000. Client, Fire District No. 2, Shelburne, Vermont.

VIRGINIA

Lee Kendrick & Associates
Arlington, Virginia

¶ Addition to Fairfax Methodist Church, Fairfax, Virginia. (mech., elec.) Client, Allen J. Dickey, Architect.

¶ Tyler building, Arlington Towers, Arlington, Virginia. (mech., elec.) Client, Arlington Towers Inc.

¶ South Gate Motel, Arlington, Virginia. (mech., elec.) Client, Mr. Wright.

WISCONSIN

Lawrence E. Peterson, Jr.
Milwaukee, Wisconsin

¶ Addition to warehouse, Milwaukee, Wisconsin. (complete design). \$150,000. Client, Badger Paint & Hardware Co.

FOREIGN

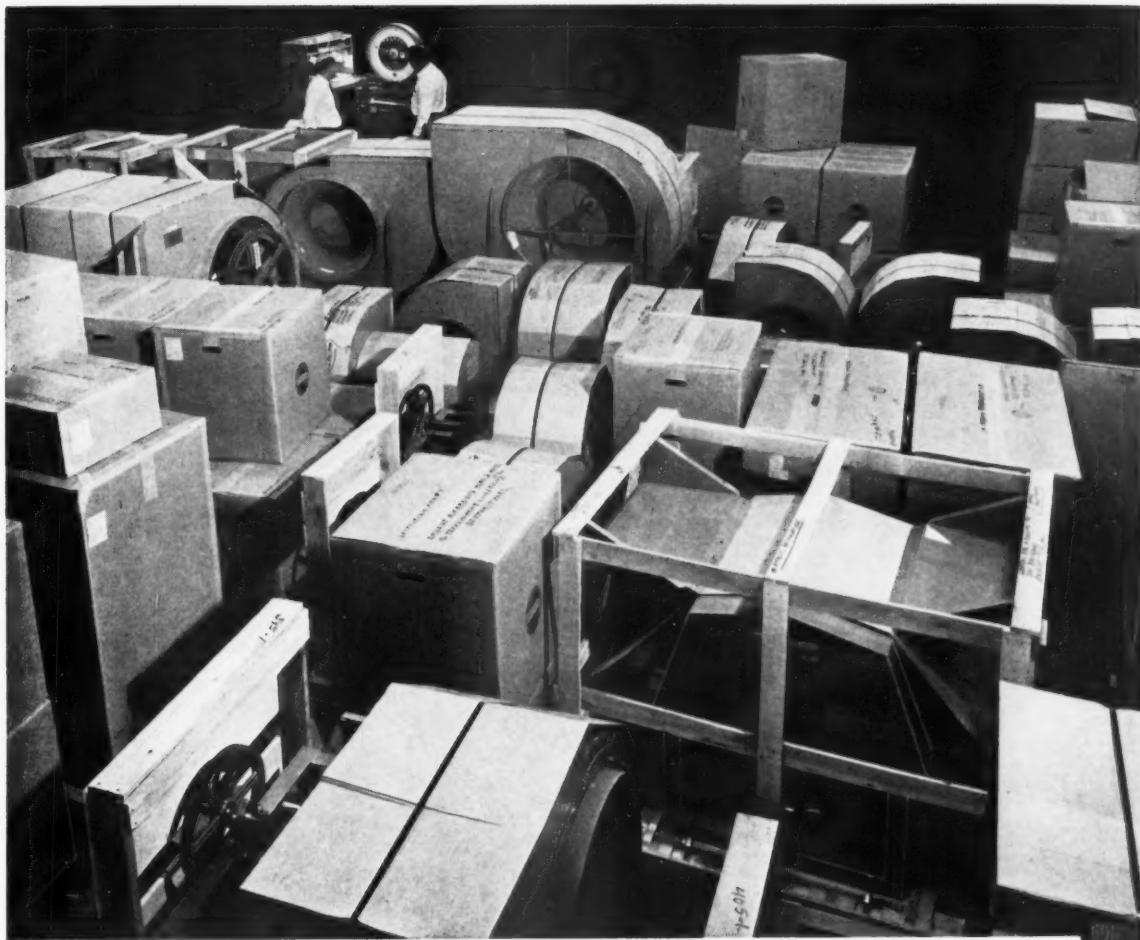
T. G. Anglin Engineering Co. Limited
Montreal, Quebec, Canada

¶ Bell Telephone Company C. A. M. A. Building, Montreal, Quebec. (mech., elec.) \$510,000. Client, Durnford Bolton, Chadwick & Ellwood, Architects.

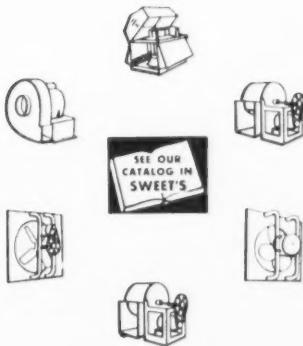
¶ Queen's University, third unit of men's residence, Kingston, Ontario. (mech., elec.) \$340,000. Client, Barott, Marshall, Merrett & Barott, Architects.

¶ McGill University swimming pool building, Montreal, Quebec. (mech., elec.) \$75,000. Client, Durnford Bolton, Chadwick & Ellwood, Architects.

¶ Office building for Prudential Insurance Co., Ltd. of England, Montreal, Quebec. (mech., elec.) \$750,000. Client,



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- An order for Peerless Electric air moving equipment may contain several sized units. All orders are shipped complete, where specified, so that the entire installation can proceed at the job site. Orders are made up as per customers' specifications at this "gathering depot" and moved to the shipping docks for transportation to place of delivery.

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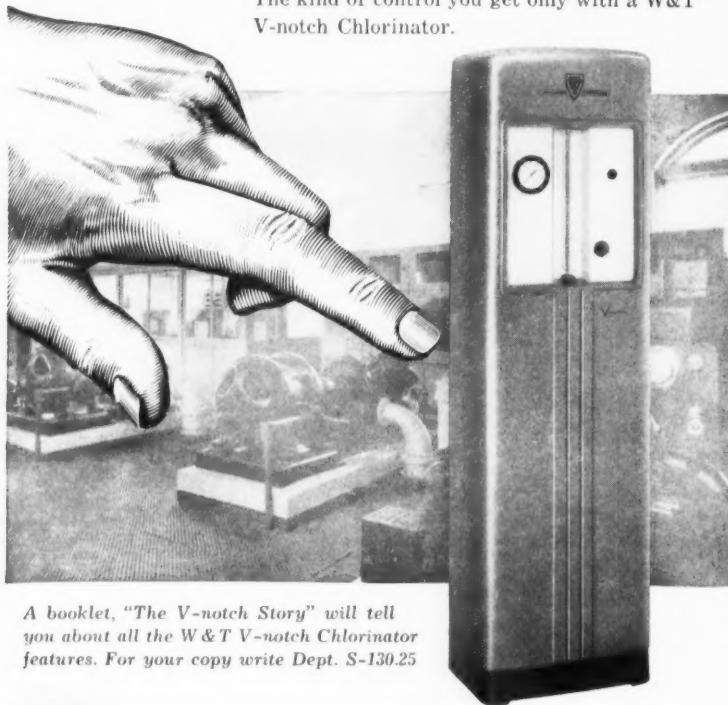
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And, of course, the right plastics make the whole chlorinator chlorine-proof.

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Barott, Marshall, Merrett & Barott, Arch.
Edinborough school building, Montreal,
Quebec. (mech., elec.) \$160,000. Client,
Dobush & Stewart, Architects.

C. G. Russell Armstrong
Windsor, Ontario, Canada
Harrow waterworks system, (civil)
\$390,000; (mech., elec.) \$50,000. Clients,
Ontario Water Resources Commission and
Town of Harrow.

Essex County integrated water scheme.
(civil) \$3 million; (mech.) \$350,000;
(elec.) \$80,000. Client, Ontario Water
Resources Commission.

Riverside-Tecumseh Joint Water Works
Board. (civil) \$580,000; (mech., elec.)
\$300,000 (est.). Client, Riverside-Tecumseh
Joint Waterworks Board.

Brais, Frigon & Hanley
Montreal, Quebec, Canada
Rehabilitation, Institute of Montreal.
(mech., elec.) \$2.5 million. Client, Owner.
New wing to St. Benoit Mental Hospital,
Montreal. (mech., elec.) \$400,000.
Client, Gascon, Parant & Auger, Arch.

Brett-Ouellette-Blauer-Associates
Montreal, Quebec, Canada
Place Ville Marie, a Rockefeller type
office building and plaza development, located
in the heart of downtown Montreal.
(civil) \$25 million; total cost \$100 million.
Client, Webb & Knapp (Canada) Ltd.

Marc Gilbert
Quebec City, Quebec, Canada
Under study—combined sewer system,
collectors to St. Lawrence River. (civil)
\$600,000. Client, Town of Courvilles,
Quebec, Canada.
Under study—sanitary sewer system.
(civil) \$350,000. Client, Town of La
Petite Riviere, Quebec, Canada.

McDougal & Friedman
Montreal, Quebec, Canada
Concert hall—first stage of Cultural
Centre in Montreal, Quebec. (mech.,
elec.) \$6 million. Client, Corporation Sir
Georges-Etienne Cartier.

J. U. Moreau & Associates
Trois-Rivieres, Quebec, Canada
New Institute of Technology building,
Trois-Rivieres, for Provincial Department
of Youth and Social Welfare. (mech.,
elec.) \$2 million. Client, Provincial Govt.
Site development and municipal services
for 800-home residential project including
complete sewage treatment plant,
vicinity of Trois-Rivieres, Quebec.
(civil, mech., elec.) \$1 million. Client,
Terrasse Duvernay Inc.

Zumwalt & Vinther
Dallas, Texas
Athens Hilton Hotel, Athens, Greece.
500-room luxury hotel, air conditioning
throughout. (mech.) \$7.5 million. Client,
Vassiliadis, Vourekas and Staikos,
Architects, Athens, Greece.
Trinidad Hilton Hotel, Port-of-Spain,
Trinidad. 264-room luxury hotel, air
conditioning throughout. (mech., elec.)



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steel pipe**

*will serve the
futuristic structures
of his day*

Tomorrow's imposing, functionally-designed office buildings, hotels, schools and apartments—the structures of his day—will make daily living an undreamed of pleasure . . . quite different from that of Dad's time. Youngstown is anticipating tomorrow's need for bigger and better pipe. Our metallurgical research and expanding production facilities will make certain that when tomorrow's construction engineers call for better steel pipe . . . Youngstown will supply it in quantity.



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Youngstown, Ohio

Manufacturers of Carbon, Alloy and Tool Steel

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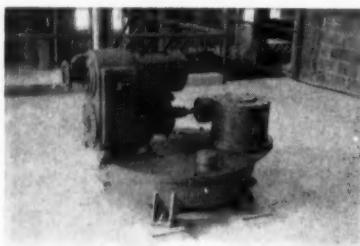
View of the exterior of the new Rolland Paper Company water treating plant, designed to purify 4,000,000 gallons of water a day, and housing a Hardinge Automatic Backwash Sand Filter.

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One of the most recent acquisitions has been a Hardinge Automatic Backwash Sand Filter, plus Flocculation Units, all combined to give them a complete water treatment plant for controlling the quality of their process water.

With good water continuously available as a basic ingredient for their process, product quality control is simplified. The vagaries of nature, bringing sudden storms to muddy-up raw water sources, are once again only a natural phenomenon, a joy to the farmer, and a prelude to rainbows.



Driving mechanism for one of two Hardinge Flocculating Units which precede the ABW Filter.



General view of the Rolland Paper Company water treatment plant interior showing the 12 1/2' x 76' Hardinge Automatic Backwash Sand Filter. The backwash mechanism travels from end to end of the filter tank along tracks on the sidewalls.

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COMPANY, INCORPORATED

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\$4.5 million. Client, Warner, Burns, Toan & Lunde, Architects, New York.

Stadler Hurter International Ltd.

Montreal, Quebec, Canada

Engineering services for complete integrated pulp and paper mill. Daily capacity, 100 tons; raw materials, rice straw, reeds, bulrushes; location, near Alexandria, Egypt. (civil, struc., mech., elec.) \$9 million. Client, "RAKTA" Societe Generale de l'Industrie du Papier, Cairo, Egypt.

Foundation of Canada

Engineering Corp., Ltd.

Toronto, Ontario, Canada

Mill office, Sault Ste. Marie, Ontario. (struc., civil, mech., elec.) \$200,000. Client, Algoma Steel Corp.

Bloom and plate mill, Sault Ste. Marie, Ontario. (struct., civil, mech.) \$15 million. Client, Algoma Steel Corp.

Warehouse and office, Chatham, Ontario. (struc., civil, mech., elec.) \$900,000. Client, Continental Can.

Hard board mill, Calgary, Alberta. (struc., civil, mech., elec.) \$2.5 million. Client, Gypsum Line & Alabastine.

Office and dry, Atikokan, Ontario. (struc., civil, mech., elec.) \$1 million. Client, Caland, Ore.

Rainy Lake bridge, Rainy Lake. (struc., civil, elec.) \$3.5 million. Client, Department of Highways, Ontario.

Homes bridge, St. Catharines, Ontario. (struc., civil, mech., elec.) \$15 million. Client, Dept. of Highways, Ontario.

Bay of Quinte causeway report. (struc., civil, mech., elec.) \$2.5 million. Client, Department of Highways, Ontario.

James A. Barr

Mt. Pleasant, Tennessee

Mine and flotation plant, Dakar, Senegal (struc.) \$5 million. Client, Compagnie Senegalaise des Phosphates De Faiba.

Vandament & Darmsted

San Francisco, California

Headquarters for the American consulate in Italy. (mech., elec.) \$400,000. Client, Mario J. Campi.

Kain & Hooven

Lansdowne, Pennsylvania

Brewery, building, Mayaguez, Puerto Rico. (struc.) \$350,000. Client, William F. Koelle Sons, Consulting Engineers.

Montgomery & Kohloss

Honolulu, Hawaii

Classroom building, University of Hawaii. (mech.) \$70,000. Client, McAuliffe, Young & Associates, Architects.

Young Buddhists Association gymnasium. (mech.) \$15,000. Client, Kenji Onodera, Architect.

Young Men's Christian Association Building, Kailua, Oahu. (mech.) \$10,000. Client, McAuliffe, Young & Assoc., Arch.

Facilities for Honolulu Japanese Chamber of Commerce. (mech.) \$20,000. Client, Katsuyosi and Fuchino, Architect & Engineer.

SCHAUB
POWER PLANT
Boiler Feed Pumps



This Schaub Impeller has a surface hardness nine-tenths that of a diamond (1100 Brinell). This super-hard "skin" INCREASES IMPELLER LIFE UP TO 300%. Resists wear, corrosion, erosion—will not chip, peel or spall. When or if it eventually wears through, the base metal in its original dimension still has a normal service expectancy.



MAIL COUPON FOR TECHNICAL
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Capacities, ratings, general pump facts, specifications, dimensions. Designed for power and consulting engineers.

Now you get

**all TURBINE PUMP
advantages...
with
DOUBLED
SERVICE LIFE**

With Schaub Power Plant Pumps and their almost diamond-hard ELECTROLIZED IMPELLERS, you can count on *double* the service life you'd normally expect from a standard fitted turbine pump! They offer all the turbine-type's inherent advantages: wide head range without motor overload or cavitation. And in every "over-strength" component they match the extraordinary durability of their impellers. Features like these make maintenance and service almost negligible:

- Oversize pre-lubricated double-row ball bearings
- Improved Fleximatic Shaft Seals—no packing problems, scored shafts, lubrication wash-out or leaks. (Seals can be replaced in minutes when necessary without dismantling the pump.)
- Extra heavy duty housing, shafting and bearing arms keep pumps "in-line" and prevent warpage.
- Excellent NPSH characteristics — certified GPM performance at suction heads as low as 3 feet!

Schaub Power Plant Pumps are *standard* on most larger Schaub Boiler Feed Systems and available for individual pump and replacement needs. Specified either way, you get the most durably engineered turbine type pump yet produced.

FRED H. SCHaub ENGINEERING COMPANY
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Williams Efficiency Waterstopps are made from Natural Rubber Stock, and designed for maximum effectiveness in any type of cast-in-place construction joint. They will bend around corners—will not crack or tear from shear action. Tensile Test: 3990 lbs.; Elongation Test: 650%. Available in rolls up to 80 feet in length. Field splicing is simple. Williams Waterstopps can also be furnished in Vinyl or Neoprene for industrial uses where resistance to oil and other injurious wastes is desirable. These highly effective Waterstopps are now in use in hundreds of industrial plants, commercial and public buildings throughout the country.

See Sweet's, or Write for Information.

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Consulting Engineers' Calendar

April 1. American Institute of Consulting Engineers; Luncheon Meeting, Engineers Club, New York, N.Y.

April 5-10. Engineers Joint Council; Nuclear Congress, Municipal Auditorium, Cleveland, Ohio.

April 6-8. Building Research Institute; Annual Meeting, Penn-Sheraton Hotel, Pittsburgh, Pennsylvania.

April 16-17. American Institute of Electrical Engineers; Electrical Problems in the Cement Industry Conference, Allentown, Pennsylvania.

April 19-23. American Society of Mechanical Engineers; Oil and Gas Power Conference, Shamrock-Hilton Hotel, Houston, Texas.

April 28. Association of Consulting Chemists and Chemical Engineers, Inc.; Symposium and Banquet, Shelburne Hotel, New York, N.Y.

April 29-May 2. Consulting Engineers Council; Third Annual Meeting, Biltmore Hotel, New York, N.Y.

May 4-6. Construction Specifications Institute; National Convention, Palmer House, Chicago, Illinois.

May 4-8. American Society of Civil Engineers; Cleveland Convention, Hotel Cleveland, Cleveland, Ohio.

May 6. American Institute of Consulting Engineers; Luncheon Meeting, Engineers Club, New York, N.Y.

May 11-13. American Society of Mechanical Engineers, American Institute of Electrical Engineers, Institute of Radio Engineers; Joint Automation

Conference, Pick Congress Hotel, Chicago, Illinois.

May 11-13. Instrument Society of America; Annual Power Conference, President Hotel, Kansas City, Mo.

May 20-21. Building Research Institute; Conference on Building Illumination, Statler-Hilton Hotel, Cleveland, Ohio.

May 20-22. American Society of Civil Engineers; Jet Airport Conference, Shamrock-Hilton Hotel, Houston, Tex.

June 3. American Institute of Consulting Engineers; Luncheon Meeting, Engineers Club, New York, N.Y.

June 14-18. American Society of Mechanical Engineers; Semiannual Meeting, Chase-Park Plaza, St. Louis, Mo.

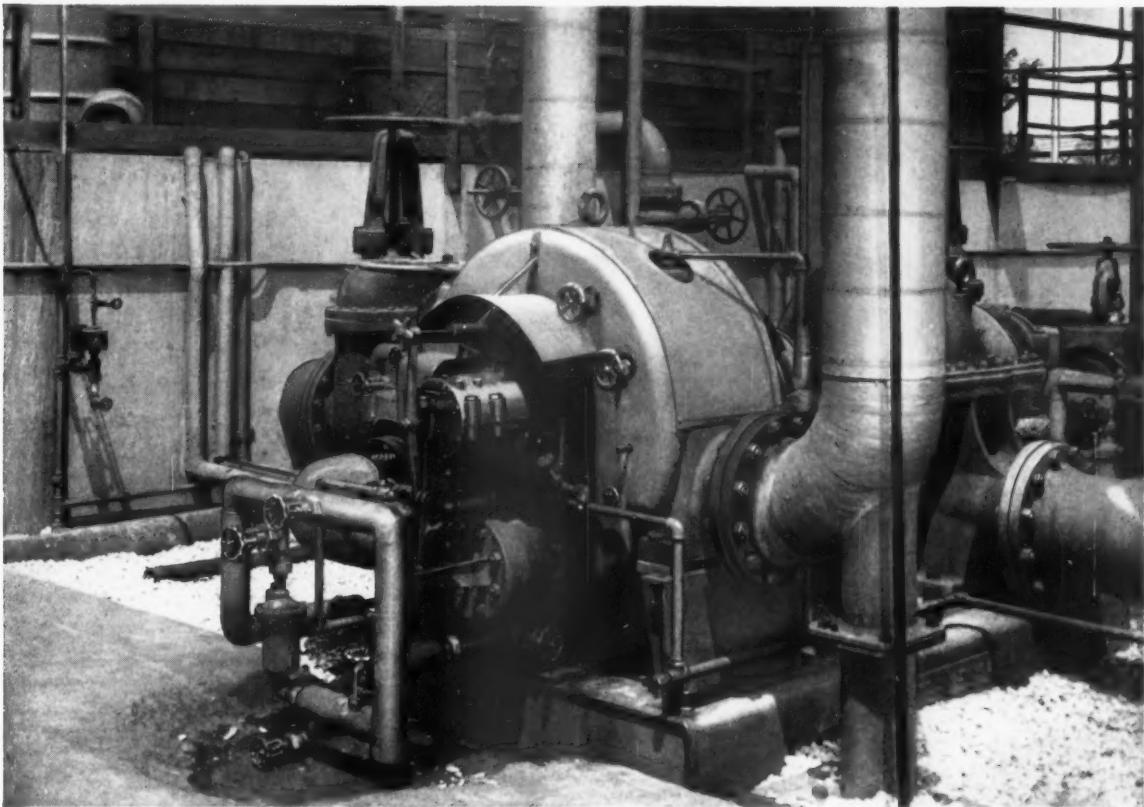
June 17-20. National Society of Professional Engineers; Annual Meeting, Commodore Hotel, New York, N.Y.

June 21-26. American Institute of Electrical Engineers; Summer and Pacific General Meeting, Olympic Hotel, Seattle, Washington.

June 22-23. Illuminating Engineering Society; Great Lakes Regional Conference, Statler Hotel, Buffalo, N.Y.

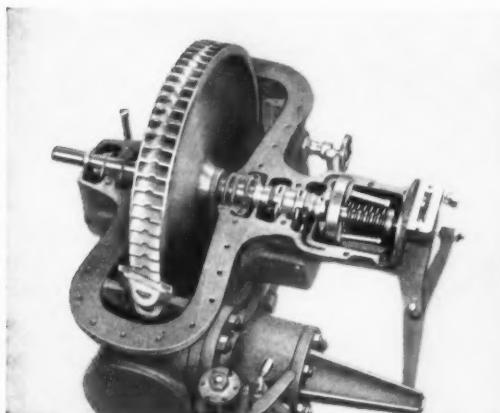
August 9-12. American Society of Mechanical Engineers, American Institute of Chemical Engineers; Heat-Transfer Conference, University of Connecticut, Storrs, Connecticut.

August 25-27. American Institute of Electrical Engineers; Petroleum Industry Conference, Wilton Hotel, Long Beach, California.



TERRY SOLID-WHEEL TURBINES

used exclusively at Baton Rouge plant of W.R. Grace & Co.



The upper photograph shows one of the 17 Terry turbines installed at the Baton Rouge, La., GREX high-density polyethylene plant of W. R. Grace & Co. Above, a typical Terry solid-wheel turbine with cover removed to show the wheel construction.

In purchasing equipment for their new 50,000,000-pound high-density polyethylene plant, W. R. Grace & Co. standardized, wherever possible, on a single source of supply for each type of equipment used. Consistent with this policy, Terry steam turbines were used exclusively throughout the utility and process sections of the plant.

A total of 17 turbines were placed in service for driving pumps and fans. These are all of the solid-wheel type, ranging in capacity from 50 to 240 HP.

Terry solid-wheel turbines are known for their long life and sure dependability under the most-trying operating conditions. They feature a single-piece wheel which is virtually indestructible.

Send for details of these trouble-free turbines. Ask for a copy of bulletin S-116.

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD 1, CONN.

TERRY

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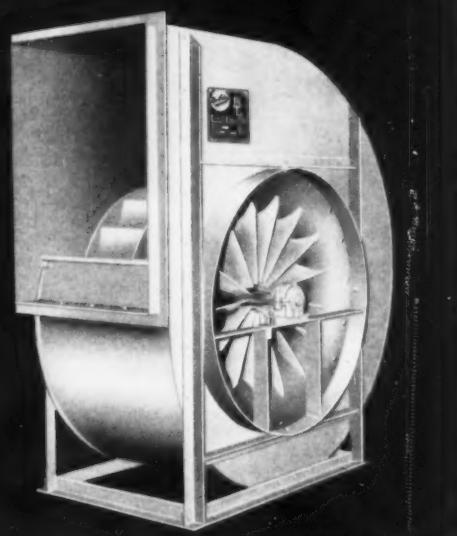
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For Classes III-IV (High Pressures) The "Buffalo" Type "BLH" Fan



For Classes I-II (Moderate Pressures) The "Buffalo" Type "BL" Fan

FOR THE BEST ENGINEERED JOBS, SPECIFY BUFFALO "JOB-SUITED" FANS

For central system applications you don't have to accept a "compromise fan", loosely designed to cover any and all pressure requirements. "Buffalo" builds *two* fans, each engineered to fulfill specific pressure requirements to the highest possible degree. Brief engineering details on these "no compromise" "Buffalo" Fans are given below.

The "Buffalo" Type "BLH" Fan is recognized by engineers and contractors alike for its outstanding performance in Classes III and IV service. The "BLH" maintains an extremely high mechanical efficiency of 86% over a broad operating range. The smooth inlet bell with matching shroud, directional inlet vanes, backward-curved blades and divergent outlet all contribute to quiet operation and minimum turbulence. "Buffalo" engineering features, plus husky construction, add up to an efficient high pressure fan that will deliver long, faithful, maintenance-free service. When you plan a conduit system or other Class III-IV installation, be sure to specify the "BLH". Call in your "Buffalo" representative or write for Bulletin F-200.

The "Buffalo" Type "BL" Fan has gained wide acceptance for peak performance in major Class I and II installations throughout the country. Non-overloading, the "BL" provides quiet, stable, output from free delivery to shutdown. The smoothly-curved inlet bell, with directional guide vanes and matching shroud, assures minimum turbulence. Highest efficiency is attained by the streamlined wheel with backward curved blades, factory tested and balanced to hold vibration to an absolute minimum. The correctly shaped scroll of the wheel-contoured housing further contributes to smooth air flow. For full information on the rugged, reliable "BL" Fan for Class I and II conditions, contact your "Buffalo" engineering representative. Or, write direct for Bulletin F-104.

You get a *value dividend* with the "Q" Factor — the built-in QUALITY that provides trouble-free satisfaction and long life in *every* "Buffalo" product.



BUFFALO FORGE COMPANY • Buffalo, New York

Buffalo Pumps Division, Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

longer, stronger AMVIT Jointed Clay Pipe prevents infiltration SIX WAYS

*Bottletight, Factory-Made Joint
of Plasticized Resins of Polyvinyl-
chloride gives lower cost-in-place*

Engineering standard and specifications for sanitary sewers are written so that both the contractor and the community can obtain the best type of construction.

They limit the amount of infiltration in sewer pipe joints, which, in turn, reduces pumping and treatment plant costs. Amvit* Jointed Clay Pipe was especially designed to achieve best possible results.

1. FACTORY-MADE QUALITY

The Amvit Joint is manufactured from plasticized resins of polyvinyl-chloride. No other combination of materials is used or needed. It is applied on the pipe by a special manufacturing process and delivered to the job site ready for immediate installation.

Thus, infiltration, exfiltration, and root penetration are prevented.

3. QUICK, FOUL-PROOF INSTALLATION

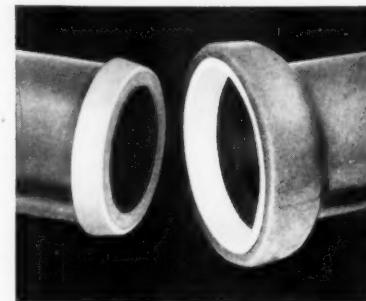
The joint is on the pipe delivered to the job site ready for immediate installations. No other materials such as caulking, joint compound, hot pots, or lades are needed to make the Amvit Joint.

2. DESIGN PREVENTS LEAKS

The Amvit Joint is a compression type joint based on the ball and socket principle. The material on the spigot end is a convex shape, with the bell end in a concave shape. Simply pushing the pipe together "makes" the joint, keeping the surfaces of the bell and spigot rings in constant compression.

4. PERMITS DEFLECTION, ABSORBS SHOCKS

Amvit is made from a plastic which has many characteristics similar to rubber. It is pliable, permitting deflec-



tion without leakage. It is resilient, can absorb shocks, and vibration.

5. BETTER FLOW, LESS MAINTENANCE

The design of the joint assures that the pipe is self-centered at all times. This gives perfect alignment and self-cleansing action. Because the joint is really tight, no foreign matter such as dirt, sand, or stones can possibly enter the line.

6. COMPLETE FITTINGS

Amvit is furnished on all standard fittings, as well as pipe. This will permit a uniformly tight line from house to treatment plant.



Amvit Jointed Clay Pipe, in sizes 4" through 24", together with all fittings is available for immediate delivery in the Northeast and Central States.

For more information on how Amvit can help cut your sewer installation costs, write or call American Vitrified Products Company, National City Bank Building, Cleveland, Ohio, or our office nearest you, for this descriptive folder.



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CLEVELAND, OHIO

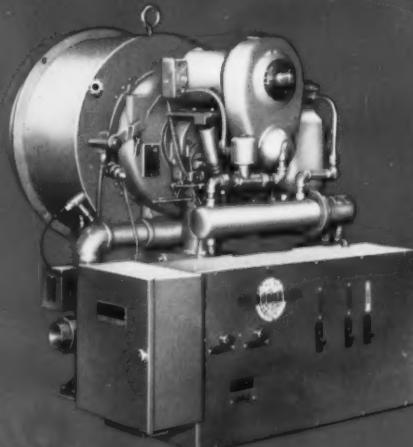


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LIGHT OR HEAVY OIL OPERATION

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These factory assembled units are ready for application as complete combustion systems to multiple pass Scotch Marine, Water Tube and Firebox boilers and to other types of heat receivers designed for pressurized operation.

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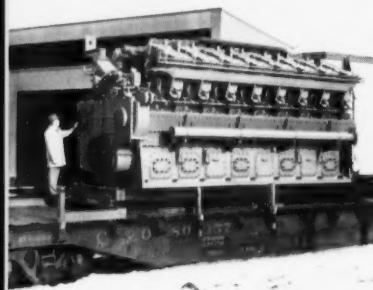
ARE YOU AN ENGINE EXPERT?

An interview with William M. Kauffmann, Chief Engineer of the Engine Division, Worthington Corporation An engine is only as good as the design philosophy behind it. In this short interview, Mr. Kauffmann answers some of the questions most frequently asked him. If you would like to have more complete information about the Worthington line of engines and engine compressors, won't you write to Worthington Corporation, Section 43-6, Harrison, N. J. In Canada: Worthington (Canada) Ltd., Brantford, Ontario.



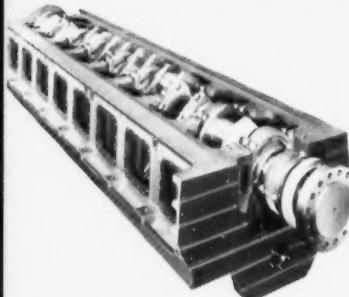
WHAT SPEED RANGE SEEMS BEST FOR CONTINUOUS-SERVICE HEAVY-DUTY ENGINES OF 1500 TO 5000 HP? Q.

A. Our belief is engines can operate safely today at speeds in the neighborhood of 500 rpm. Shafts can be designed free of critical vibrations through all speed ranges. Of course, other advantages obtained from higher speeds are smaller and less costly generators, less required floor space.



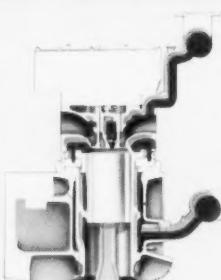
IS THERE ANY DIFFERENCE IN ACCESSIBILITY OF ENGINES IN THE SIZES MENTIONED ABOVE? Q.

A. Yes, there is. Some engines maintain underslung crankshaft design commonly used on automotive type engines. We agree with the merits of that design on small engines which can be rolled over for access to bearings. In the larger stationary types, we believe the crankshaft should be supported in the base and accessibility to bearings provided through amply large side openings.



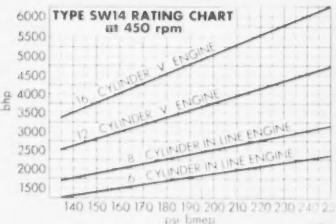
WHAT ARE ADVANTAGES OF INTEGRAL CYLINDER JACKET CONSTRUCTION? Q.

A. The major advantage is simply this: conventional design using wet sleeve liners and sealing rings may be subject to possible leakage of cooling water into the crankcase. The one-piece liner and jacket construction eliminates this problem. In addition, this type of construction provides for more efficient cooling by means of the annular water space. As such, it is particularly adaptable for high temperature cooling.



Q. HAS THE MODERN ENGINE REACHED ITS LIMITS IN BMEP?

A. Certainly not. Our SW14 engine, while presently rated at 169 BMEP, was structurally designed for ratings in excess of 200 BMEP. Current research has shown the wisdom of our thinking since we have actually operated this engine in our Research Department at over 200 BMEP.



Q. WILL MEDIUM SPEED ENGINES BURN RESIDUAL FUEL SUCCESSFULLY?

A. Field installations of these units, operating continuously on residual fuels, and reliably supplying power at lowest cost, have demonstrated that this answer is "yes." Contributing to this successful performance is the pre-injection principle patented in Worthington's dual plunger pump. More complete combustion is obtained by introducing a pilot charge ahead of the main charge.



Q. WHAT OTHER TYPES OF FUELS CAN BE UTILIZED?

A. Modern turbocharged engines designed in accordance with Worthington's tri-power principle readily operate as dual fuel, spark ignition or oil diesel—with no change of compression ratio or major engine components. Experience with almost 2-million installed horsepower of all of these combinations in successful operation, provides us with a generous background for future progress in the field of fuel utilization.

